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Barbourisidae, A New Family of Deep Sea Fishes

By A. E. PARR [1]

DURING the 1937 expedition to the Gulf of Mexico, undertaken jointly by the Woods Hole Oceanographic Institution and the Bingham Oceanographic Laboratory of Yale University, a beautiful and taxonomically peculiar new deep sea fish was obtained in perfect condition, being still alive when brought aboard. Until more specimens are caught so that an anatomical investigation can be made, the true systematic position of the species and family must remain in doubt. On the basis of a great many general similarities to the Cetomimidae the new family is tentatively referred to the Iniomi. But there would still seem to be reason to suspect that such a family as the Cetomimidae, which in the present inadequate state of our knowledge is characterized more by the features it lacks than by those it possesses, may only represent a very artificial assemblage of forms resulting from a convergent evolution, which may consist in part of a widely generalized pattern of generation under deep sea conditions of life. The author has previously [2] had occasion to transfer a genus (*Rondeletia*) from the Iniomi to another order. A similar fate may ultimately befall other members of the Cetomimidae and perhaps also the new family herein described. But there is no family known to the author into which the new genus and species could possibly fit. The integrity of the family, as such, therefore seems clear, regardless of uncertainties about its precise position in the system.

The author takes great pleasure in naming the new genus and family after the distinguished naturalist Thomas Barbour, Director of the Museum of Comparative Zoology.

FAMILY *Barbourisidae*

Ventral fins present, abdominal. Four gills, a moderate slit behind the fourth. Gillrakers present, slender and fairly long. Skin loose but very tough, densely covered with microscopic spines creating a faintly furry appearance and a notably adhesive quality. No adipose fin. All fin rays soft and apparently all articulate. Dorsal and anal fins essentially opposite and confined to the tail. Caudal fin broad. A free caudal peduncle. Lateral line well developed. General shape of head and body, form and arrangement of vertical fins as in *Cetostomus*.

The presence of ventral fins and the character of the skin immediately distinguish this family from the Cetomimidae.[3] The well developed slender gillrakers and the presence of four gills add further distinction from the subfamily Cetomiminae [4] in which gillrakers are absent and only three gills are found.

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[1] American Museum of Natural History and Bingham Oceanographic Laboratory.

[2] A contribution to the osteology and classification of the orders Iniomi and Xenoberyces. Occas. Pap. Bingham Oceanographic Coll. No. 2, 1929.

[3] In the Cetomimidae the skin is always black, rather delicate, smooth and scaleless. In Vol. 4 of the Records of the Albany Museum (Grahamstown, South Africa, 1935: 180–181), J. L. B. Smith has corrected Gilchrist's statement that scales are present in *Pelecinomimus picklei* Gilchr. and has transferred this species to the genus *Cetomimus*.

[4] See A. E. PARR: Report on experimental use of a triangular trawl for bathypelagic collection. Bull. Bingham Oceanographic Coll., 4 (6), 1934: 20-32.

Genus *Barbourisia*

External skin without evidence of chromatophores or solid pigmentation in the preserved specimen, but suffused with a (liquid?) pigment in life. Lateral line pores small, round and uniform, without flaps. Teeth minute, in bands, extending the whole length of both jaws, on the pterygoids and in a round patch of the vomer. No teeth on palatines. Large patches of teeth on pharyngeals, none on tongue. Eyes small. Mouth very large. Head and body moderately compressed. Dorsal and anal fins moderate (D about 20, A about 16). Paired fins small, but well developed (V ab. 6, P ab. 13). 7 soft branchiostegal rays.

The dentition described above adds another feature of strong resemblance to the Cetomimidae, except for the absence of teeth on the palatines, which has not been reported in any cetomimid.

The skin of the entire abdominal region is drawn into numerous very fine, but long, transverse wrinkles, and the body musculature of the mid-ventral line from anus to the base of the shoulder girdle is lacking or extremely degenerate. Both of these features suggest a capacity for great expansion of the abdominal cavity, which, however, does not seem in too good accord with the minute dentition of the jaws.

Barbourisia ***rufa,*** n.sp.

The length of the type specimen measures 180 mm. from the snout to the base of the middle rays of caudal fin. The following measurements are stated in percentage of this length (180 mm. = 100 percent). Length of head 35.6. Snout 11.7. Diameter of orbit 4. Length of upper jaw 25.6. Length of lower jaw 28. Greatest width of skull 15. Interorbital width 12.5. Distance from snout to dorsal fin 64. Snout to anal fin 69. Snout to ventrals 54–55. Length of dorsal fin base 24. Anal fin base 18. Depth of caudal fin between edges of procurrent spines 14. Width of ventral fin base measured at right angle to fin rays 1.3–1.5. Width of pectoral fin base at right angle to rays 2.2. Length of pectoral rays 6.5–7. Length of ventral rays 6–6.5. Dorsal rays 10.5–11. Anal rays 10–10.5. Depth of body at shoulder girdle 25. Least depth of caudal peduncle 5. Distance from dorsal or anal fin to procurrent caudal spines 8. Distance from dorsal or anal to base of middle caudal rays 14.5. Longest gillrakers 4–4.2.

D. 20. A. 16. P.B.V. 6.

Caudal fin with 19 articulated, main rays, of which 17 are divided. 9 procurrent rays above and 7 or 8 below the caudal peduncle. Although the proximal portions of the fin rays in all fins are quite thick and substantial, the distal parts of the rays are thin and delicate, apparently free from the fin membranes, and mostly lost. The fin ray measurements given in the preceding paragraph include the filamentous ends. Fin-membranes of dorsal and anal fin extremely delicate, splitting very easily, probably both in life and in death, thereby giving the appearance that the rays of these fins are largely free also in their thick proximal portions.

Gillrakers 6 in the upper, 14 in the lower branch of the first arch. In lateral line 29 pores; a slight irregularity is notable in the region of the

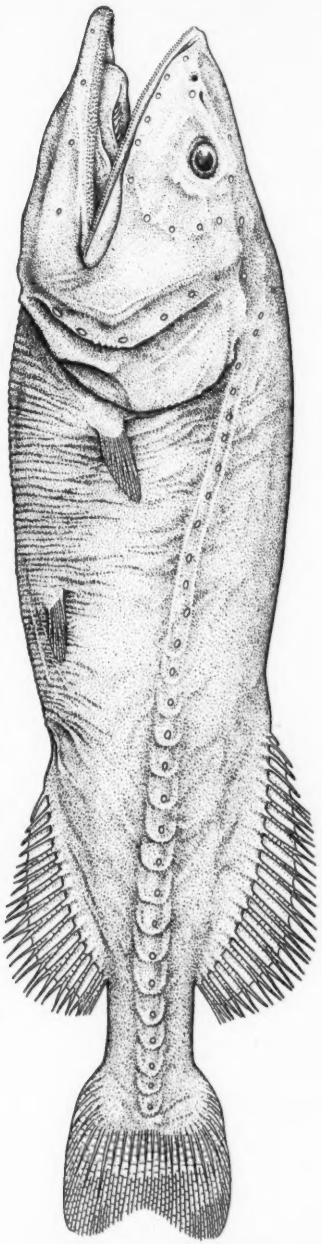

Plate I. *Barbourisia rufa*, n. sp. Drawn by J. Roemhild.

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12th to the 14th pore, with one or two pores conspicuously elevated above the line through the others.

The figure and measurements already given leave very little more to be said about the general appearance of the species. The ridges of the head are rather low; the dorsal profile almost straight, with only a very slight concavity in the interorbital region. Viewed from above the top of the head seems rather flat and broad. The eyes are entirely lateral and do not appear in the dorsal view. Two small, simple nostrils, the diameter of the anterior, round, nostril measures only 1 mm.

There is a wide emargination of the outer cover between operculum and suboperculum, exposing the upper branchiostegal rays, and a secant of thickened branchiostegal membrane of the same microscopically spiny character as that of the external skin generally. These features of the gill cover might be included in the generic diagnosis.

The external skin is entirely free from pigmentation but was in life suffused with a bright geranium red (Ridgway) uniformly distributed on all parts, including the fins, making the living specimen an object of beauty. The microscopic spines extend over all external surfaces, including head, jaws and fin-rays, and are easily revealed by the furry, adhesive quality they lend to the skin. Interior of mouth white. Peritoneum and interior of gill cavity black.

Type specimen: No. 1217 Bingham Oceanogr. Coll. Atlantis Station 2852, March 28, 1937. 27°01'N. 94°22'W. Gulf of Mexico. 750–1000 meters depth. Bottom depth 895 fathoms.

American Museum of Natural History, New York.

The Record of a Fish, *Scorpaena mystes*, from California: A Comedy of Errors [1]

By Carl L. Hubbs

In preparing a much needed check-list of the fishes of California W. I. Follett becomes concerned with what he rightly regards as "the seemingly improbable record" of *Scorpaena mystes* from this state. He suggests that I check on the material in the Scripps Institution of Oceanography on which Fowler (1923: 299) based his La Jolla record of *Scorpaena mistes* [sic] Jordan and Starks. Following through with this suggestion I find in the Scripps Institution collection one specimen, labelled *Scorpaena mystes*, which must have been the basis for the single California record of this tropical American Pacific species. There are no other examples of this species in the collection and no mention of any others on the card index.

From an examination of this specimen and of the corresponding card it seems certain that *Scorpaena mystes* has been reported by error from California. In the first place the fish in question (S.I.O., No. 99) is totally without data, other than the statement that it was collected by the "Inst."

[1] Contributions from the Scripps Institution of Oceanography, New Series, No. 262.

This makes it probable but by no means certain that the example was collected locally. Hence even if the identification were correct, which it is not, the record for California would hardly have been justified. The specimen proves, as was expected, to be a misidentified example of the locally abundant California "sculpin," *Scorpaena guttata* Girard, the only species of one genus definitely known from California. The one record of another species from the state—that of Evermann and Latimer (1910: 137) for *Scorpaena histrio* from San Pedro—will presumably also prove to have been based on *S. guttata.*

In the specimen erroneously identified as *Scorpaena mystes* the dorsal rays number XII, 8, not XII, 10 as is generally reported for both *guttata* and *mystes.* Since other examples of *guttata* examined have 9 dorsal soft-rays the reduction to 8 may be assumed to be an individual variation. Apparently Jordan and Evermann (1898: 1839–1854) and some other authors have counted separately in *Scorpaena* the two terminal dorsal ray elements which they have enumerated as one ray in *Sebastodes* and other scorpaenids with more extensively branched rays. The anal fin, with similarly little branched rays, has III, 5 rays (the last double), in agreement with the usual counts. If the anal fin were counted by the same method as the dorsal has been, the formula would be III, 6. Hence ichthyologists have followed diverse criteria in counting the dorsal rays in different genera within the one family and in enumerating the dorsal and the anal rays in the same individual. Such confusing discrepancies make it very desirable, as I have repeatedly held, to adopt a single method, universally applicable without dissection or staining, for numerating the soft-rays of the dorsal and the anal fins of all fishes with lepidotrichia. The simplest and best criterion is seemingly that of counting as one ray the last two serial elements that are distinct from the extreme base, whether they be widely, moderately or narrowly separated or even in contact or suturally united (as recommended by Hubbs and Lagler, 1941: 16, fig. 2a).

The principal caudal rays (branched rays plus 2) number 13, as in other specimens of *Scorpaena.* This may well prove to be a generic character, for I find that 14 is the almost invariable number in several species of *Sebastodes* counted. Caudal ray counts have been unduly neglected.

The pectoral rays on each side are 18, or i, 7, x, to distinguish, in line with recent suggestions, the unbranched soft-rays as lower-case roman figures and the branched lepidotrichia in arabic. In *Scorpaena guttata* I find the pectoral ray formula to vary from i to ii, 6 to 8, ix to xi = 18 or 19. Although the pectoral ray formulas are often of systematic significance, the two species of *Scorpaena* under comparison may not differ materially in this respect, for the type figure of *S. mystes* (Jordan, 1895: pl. 52) shows i, 7, xi rays in the left pectoral.

When the misidentified specimen is compared with the type figure of *S. mystes* a marked difference is seen in the dorsal contour of the head. Instead of being nearly straight as it is indicated to be in *mystes* the contour is strongly convex. In consequence the anterior profile is much steeper. When measured with an arm protractor (an instrument that should be in every ichthyologist's kit) the angle between the lower edge of the mandible

and the profile of the snout is about 85°. In *S. guttata* the muzzle angle approximates 90°, but in the type figure of *S. mystes,* making allowance for the slightly opened mouth, it is about 62°.

As seen from in front the interorbital is deeply concave, V-shaped with the sides forming an angle of about 90°. This is true of other young to half-grown specimens of *S. guttata. S. mystes* may have a somewhat flatter interorbital, though the descriptions (Jordan and Evermann, 1898: 1847, 1849) are not adequate in precision ("not very deeply concave" for *guttata;* "not deeply concave" for *mystes*). The least width of the bony interorbital is only half as long as the orbit, not one-half wider than the orbit as stated for *S. mystes* by Jordan and Starks (in Jordan, 1895: 491). This sounds like a trenchant distinction but may be invalid or of only average significance, for age variation was not taken into account. The specimen of *guttata* under study measures only 105 mm. in standard length (5.3 inches over-all) and larger examples have a proportionately wider (and slightly flatter) interorbital. The types of *mystes* ranged to 14 inches in length. The interorbital width in the *guttata* specimen steps 8.4 times in the head, whereas in *S. mystes* this width when divided into the head length gave Meek and Hildebrand (1928: 834, 837) ratios of 5.25 or 5.28 to 8.25 (their specimens of *mystes* ranged in length from 40 to 270 mm.). At comparable sizes *guttata* probably has a narrower and deeper interorbital than *mystes,* but precise determinations of the age variation in each species are needed.

The length of the highest dorsal spine enters the head only 2.25 times. In the elevation of the spinous dorsal *S. guttata* probably differs from *S. mystes,* though the lowness of this fin in the type of *mystes* (3.5 in head) may be due in part at least to age variation, which has not been analyzed.

It is virtually impossible to determine this specimen as *guttata* or as *mystes* by the use of Jordan and Evermann's key (1898: 1840) for that analysis, like many still current, is sadly lacking in accuracy. The first distinction, "lateral line with about 50 scales" in *guttata* versus "about 30 scales in lateral line" in *mystes* is dubious. The scales above, not on the lateral line, of *guttata* are in about 50 rows but the lateral line pores are much fewer (numbering 24 in the specimen under treatment). The count of 30 for *mystes* presumably represented an error or an enumeration of the pores, for Meek and Hildebrand (1928: 837) gave the scale count for that species as 44 to 49. The distinction between the pore and the scale count should be implicit. I note now that I must have meant scales when long ago (Hubbs, 1916: 163) reporting "45 to 55 pores" in *guttata.*

The second key distinction, "no dermal flaps except small ones along the lateral line" in *guttata* and "most of the scales with dermal flaps in *mystes*" is likewise at least largely invalid, for *guttata* has an abundance of such processes over the body, as indeed Jordan and Evermann (1898: 1848) stated in their description of the species. There may well be an average difference in the size of the flaps, for the type figure of *mystes* shows them much larger than they ordinarily are in *guttata.*

The third reputed distinction, "supraorbital tentacles small" in *guttata* and "supraorbital flap large, longer than eye" in *mystes,* is inadequate. In *guttata* this tentacle varies from lacking to almost as long as the orbit. In

mystes, according to Meek and Hildegrand (1928: 837), it is "variously developed or absent and is of no specific value." Variation in the length of the tentacle in *mystes* was also pointed out by Gilbert and Starks (1904: 161). There may be not even an average distinction in this character, but the specimen at hand, with the flap one-half as long as the orbit, might enter either species upon the basis of this character.

The fourth distinction, "axil pale, almost unspotted" in *guttata* versus "axil black and white spots" in *mystes,* is probably of some value though not nearly so sharp as was thus indicated. There may be one or a few small black axillary spots in *guttata.* In *mystes,* according to Meek and Hildebrand, the axil is not black with pale spots, as it usually is in its Atlantic cognate *plumieri,* but rather "is not wholly black, and it usually has only a large black spot." In the example of *guttata* misidentified as "*mistes*" the axillary color like that on the rest of the surface is lost, as the specimen was long on exhibit in the light. It is true that one axil, as well as some areas near the dorsal fin and some spots on the sides, is brownish black, but this color is obviously the remains of a dark mold that once covered the specimen, presumably as the result of the evaporation and weakening of the alcohol. It seems not unlikely that this specimen of *guttata* was misidentified as *mystes* on the supposition that the area of mold in one axil represents the black axil that was described as characteristic of *mystes!*

Although the identification was so obviously in error, it is in a way not surprising, since Fowler (1923: 294) indicated that he spent parts of only two days at Scripps Institution getting the numerous "La Jolla" records that he listed. Perhaps he merely jotted down the misidentification of one specimen of *Scorpaena* as *S. mystes* and failed to determine that this fish bears no locality data and that it is an example of *S. guttata.*

This little story leads to a conclusion of limited concern and to a moral of much wider application. The conclusion, suggested by the first part of the title, is that the tropical fish species *Scorpaena mystes* has been recorded in error as from California. The moral, associated with the second part of the title, is that much greater precision and care are urgent needs in ichthyological research and publication.

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SCRIPPS INSTITUTION OF OCEANOGRAPHY, UNIVERSITY OF CALIFORNIA, LA JOLLA, CALIFORNIA.

Contribution to a Methodology in the Caudal Fin Ray Count of Fishes and its Use in Classification

By ISAAC GINSBURG

THE PROBLEM AND THE METHOD FOR ITS SOLUTION.—The number of caudal rays as a character in the classification of fishes has been hitherto neglected or inadequately treated. Usually the caudal fin ray count is altogether omitted from descriptions. When the number of rays is stated, the method of counting is usually not explained. But as there are different kinds of rays in the caudal fin, the count depends on whether all rays are included; or one or another kind, or part of the rays of a kind are omitted. Published counts make it apparent that different authors use diverse methods of counting. Constructive comparisons are consequently not possible. The object of this article is to prove the imperative need of uniformity of method by a consideration of definite examples, and to point out the best method by which the rays are to be enumerated in the everyday practice of taxonomy.

The data herein presented are based on a study of American gobioids. A preliminary study of the caudal fin of some other families of fishes shows that the principles here evolved apparently are applicable to fishes in general.

The caudal fin of gobies has three kinds of rays: (1) Rays which are both segmented and branched. The stem of each such ray divides, at some distance from its base, into two main limbs which, in their turn, may or may not divide and subdivide dichotomously, profusely so in some species, especially in large specimens. Often a ray situated near the upper or lower margin of the fin branches much less decidedly than the inner ones, having two short primary limbs. In this study when a segmented ray divided for a very short distance at its tip it was counted with the branched rays. The branched rays usually spread nearly over the entire extent of the fin, except for narrow marginal areas above and below. (2) Segmented rays, which are unbranched, consisting of a single segmented shaft. In gobies there are generally only one to three such rays along a comparatively narrow space on the upper and lower margins of the fin. When three are present the inner one often almost reaches the posterior margin of the fin, while the other two are successively shorter. All are here included in the count, irrespective of length. (In many blennies all the segmented caudal rays are unbranched as they are also in the pectoral,

dorsal, and anal.) (3) Rays which are both unsegmented and unbranched. For brevity in discussion, they are hereafter designated as simple rays. They are placed near the base of the fin, at its upper and lower margins. The innermost is the longest one of these rays, but generally extends for less than half way between the inner and outer margin of the fin. These rays generally decrease more or less gradually and rapidly in length from within outward or from behind forward, the outermost or anteriormost ones generally being very short.

A practical difficulty in the accurate determination of the number of simple rays is that they are generally covered by thick skin and often also by scales, so that they cannot be accurately enumerated without dissection, or at least staining, courses which may be impractical or undesirable with specimens permanently preserved in collections for reference or study purposes. On the other hand, the segmented rays, both branched and unbranched, may be accurately counted with a magnifying lens or microscope by transmitted light, without special preparation.

Usually there is no difficulty in distinguishing the segmented from the simple rays, not only by the presence of a number of well-marked joints [1] in the former, but also by the more or less abrupt transitions from the former to the latter in length or thickness, or both. The innermost simple ray, the one that is placed next to the outermost segmented ray, is in most species distinctly shorter and slenderer. By these means the outermost segmented ray may usually be distinguished from the simple rays, even when its distal segmented portion is broken off. Rarely, as an individual variation, the outermost segmented ray may have the number of joints reduced to one or two, which may be but faintly marked, and the difference between the segmented and simple rays is then not so sharply defined, in that one of the criteria distinguishing them nearly disappears. But such variants are generally rare. Also, rarely what appears to be homologically the outermost segmented ray, as judged by its being rather distinctly longer or thicker than the adjacent graduated simple rays, appears to lack joints; at least joints are not visible by the usual examination of the untreated specimen with the microscope. In some such rare specimens, the apparent lack of joints may be an artifact due to preservation. Virtually no difficulty was encountered during this investigation in distinguishing between the simple and segmented rays, except now and then in *Lepidogobius newberryi;* but even in that species the number of individuals presenting some difficulty are very few.

In considering the use of caudal rays as a character in classification, a number of questions present themselves. Do they have any value at all for that purpose, and if so, what value? How are the three different kinds of rays to be enumerated for most effective use in classification? Should each kind be enumerated separately or any two kinds together or all three kinds together? What is the ontogenetic history of the rays; do some of them change from one kind to another during the growth of the individual? What is the extent of intraspecific individual variability? This paper attempts to answer these questions.

[1] The term "joint" for designating the rift-like boundary between two segments is not altogether appropriate. It is not comparable to the limb joints of a mammal or those of an arthropod; however, for want of a better term, it is so designated for brevity in discussion.

A ready opportunity to make a preliminary investigation of this problem, without undergoing the tedious labor involved in many dissections, was afforded by three lots of *Gobionellus stigmaturus* in the National Museum, numbers 57330, 57365, and 57450, comprising 43 fish. These specimens apparently were preserved originally in a weak solution of alcohol, and by their long immersion they became macerated; so that some of the skeletal parts, including the simple caudal rays, stand out with diagrammatic clearness. While these fish are of indifferent value as museum specimens, they served my present purpose very well indeed. The results of this study are set forth in Table I and the conclusions drawn from the data are discussed hereafter. With the results of this intensive study of a single species as a guide, I confined my study of other species to the most promising phase of the problem, which happens also to be the one most easily accomplished in the usual taxonomic procedure, that is, the examination of such external characters as are susceptible to accurate studies without dissection.

TOTAL NUMBER OF SEGMENTED RAYS AND ITS INTRASPECIFIC VARIABILITY.—The most surprising result obtained in the study of the 43 specimens of *Gobionellus stigmaturus* is the relative constancy of the total number of segmented rays, that is, when both the branched and unbranched segmented rays are counted together for each individual. Only 2 variants have a total of 16 segmented rays, while 41 have 17, as shown in Table I. It is evident that in

TABLE I

FREQUENCY DISTRIBUTION OF THE THREE KINDS OF CAUDAL RAYS OF *Gobionellus stigmaturus*, BASED ON THREE SAMPLES

Kind of Rays	NUMBER OF RAYS																		
	0	1	2	3	4	5	6	7	8	11	12	13	14	15	16	17	28	29	30	31	32
Simple, upper	..	..	..	..	..	..	23	18	2	..	..	..	..	..	..	..	..	..	..	..	..
Simple, lower	..	..	..	..	..	8	28	7	..	..	..	..	..	..	..	..	..	..	..	..	..
Simple, total	..	..	..	..	..	..	..	..	..	7	17	12	6	1	..	..	..	..	..	..	..
Segmented and unbranched, upper	2	15	24	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Segmented and unbranched, lower	..	22	21	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Segmented and unbranched, total	..	1	13	12	15	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Segmented and branched	..	..	..	..	..	..	..	..	..	2	16	12	12	1	..	..	..	..	..	..	..
Total segmented, including branched and unbranched	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	41	..	..	..	..	..
Total of all rays	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	8	17	11	5	2

order to present the caudal fin ray count in such a way as to give a true picture of the character of the fish, all the segmented rays should be enumerated together, and the simple rays separately. The underlying reason for this phenomenon becomes evident below where ontogeny is discussed. Further extensive enumeration of the segmented rays, in many other species, showed that the relative constancy of their number, when both branched and unbranched are counted together, is the general rule.

In most cases studied, the number is so nearly constant that it may be in-

cluded, with some qualifying phrase, in the generic definition. For instance, in 98 specimens of *Bollmannia,* representing 12 species, the number is constantly 17. In *Lythrypnus,* 1 variant with 16 segmented rays was found in 65 specimens representing 7 species; all the others have 17. In 88 specimens of *Coryphopterus,* including 3 species, 2 variants have 16, all the rest have 17. The number 17 was likewise predominant in *Microgobius* and *Garmannia,* but variants having 16 or 18 were somewhat more numerous. In all the foregoing genera the number 17 is a generic character, almost absolutely or relatively so. In *Eleotris* and related genera, the number 15 is a generic character. In the American Eleotridae, the genera are divisible by the number of caudal rays into two natural, what appear to be truly phylogenetic, groups.

Lepidogobius constitutes a notable exception among the genera intensively studied. In the 10 species of that genus in which the segmented caudal rays were enumerated, the generic range is 14 to 19. But even in that genus, each species has a decisively modal number with few variants or none. In *Lepidogobius* a certain single number may be said to constitute a subgeneric character, or nearly so.

TABLE II

RELATIVE FREQUENCY OF VARIANTS FROM THE PREDOMINANT COUNT OF ALL THE SEGMENTED CAUDAL RAYS, IN SOME GOBIID SPECIES

Species	Distribution						Percentage of Variants
	14	15	16	17	18	19	
Eleotris pisonis	..	81	..	..	..	..	0
Microgobius thalassinus	..	..	..	74	..	..	0
Microgobius microlepis	..	..	..	36	..	..	0
Microgobius tabogensis	..	..	..	33	..	..	0
Lepidogobius gilberti	..	35	..	..	..	..	0
Lepidogobius seta	..	..	..	28	..	..	0
Coryphopterus nicholsii	..	..	..	25	..	..	0
Lythrypnus dalli	..	..	..	18	..	..	0
Garmannia paradoxa	..	..	2	168	1	..	2
Garmannia chiquita	..	..	1	60	..	..	2
Lepidogobius luculentus	..	47	1	..	..	..	2
Lepidogobius guaymasiae	1	100	2	..	..	..	3
Microgobius emblematicus	..	..	1	31	..	..	3
Coryphopterus glaucofrenum	..	..	2	51	..	..	4
Lepidogobius lepidus	..	..	2	164	4	1	4
Microgobius gulosus	..	..	3	192	7	..	5
Enypnias seminudus	..	..	10	128	..	..	7
Lepidogobius y-cauda	..	35	3	1	..	..	10
Lepidogobius newberryi	..	2	8	165	9	1	11
Lepidogobius ios	..	..	5	71	5	..	12
Garmannia hildebrandi	..	..	1	26	4	..	16

Within the genera, the relative frequency of occurrence of variants differs with the species, as may be gathered from Table II, giving the data for some of the species of which fair or good samples were studied. The species are arranged in order of increasing percentage of variants. The striking comparative constancy of the count in most species becomes impressive by a mere glance at the table. Another striking fact demonstrated by Table II is that odd numbers predominate overwhelmingly. The numbers 15 and 17 are

characteristic for one species or another, while 16 and 18 occur only as variants, generally in but a small percentage of the individuals.

The most variable species of all those here considered is perhaps *Lepidogobius newberryi*. While the percentage of variants from the predominant count of 17 is somewhat less, in the composite sample studied, than in *L. ios* or *Garmannia hildebrandi*, the difference is not large (see Table II), and *newberryi* has the greatest range of distribution of any species.

VARIABILITY IN THE NUMBER OF SEGMENTED RAYS CONSIDERED SEPARATELY BY KIND.—Table I shows that each one of the two kinds of segmented rays of *Gobionellus stigmaturus*, counting the branched and the unbranched rays separately, presents considerable intraspecific individual variability, instead of the relative constancy obtained by counting them together. The same was found also in other gobies, but the degree of variability differs with the species. As the total number of segmented rays is, in nearly all species, relatively constant, it is only necessary to discuss one kind in order to gain some general idea of the variability of both kinds. One kind varies inversely as the other; the more rays of one kind present the less there are of the other, and vice versa. For this purpose the unbranched rays may best be chosen, because they show a special feature in a marked way, that of asymmetry, which may be indicated at the same time, and is discussed below.

The following data will give some general outline of the extent of variability in the number of segmented, unbranched rays. In *Bollmannia* the predominant frequency is 2 along the upper margin and 1 at the lower margin (in 52 specimens), but variants having 2 above and 2 below are rather frequent (in 10). The former constantly have 14 branched rays and the latter 13, all having a total of 17 segmented rays, as stated. This distribution, predominantly 2 and 1 unbranched with 14 branched, frequently 2 and 2 unbranched with 13 branched rays, seems to be a generic feature of *Bollmannia*. In most species of *Microgobius* the majority of specimens have 1 above and 1 below, while variants having 2 above and 1 below are more frequent than the variants in *Bollmannia*. Two species are exceptions as follows. In *M. emblematicus* there are 2 above and 1 below in the majority of specimens, with 1 above and 1 below or 2 above and 2 below very frequent. In *M. microlepis* 2 above and 2 below are predominant with 2 above and 1 below frequent. In *Lepidogobius* 1 above and 1 below is predominant in most species, with the following two exceptions. In *L. newberryi* the majority of specimens have 2 above and 2 below, while specimens having 3 and 2 in the same position, respectively, are frequent. In *L. ios* 1 above and 1 below are present in the majority, but those having 2 above and 1 below are nearly as numerous. In *Garmannia paradoxa* the predominant distribution is 2 above and 1 below, with the class 1 above and 1 below a close second. In *Enypnias*, 1 above and 1 below are predominant in *aceras*, and 1 above and none below in *seminudus*. In *Coryphopterus glaucofrenum* and *C. urospilus*, 3 above and 2 below are predominant; while in *C. nicholsii* specimens having 2 above and 1 below and those having 2 above and none below are about equal in number. In *Lythrypnus dalli* and *L. latifascia* 3 above and 3 below are predominant.

In speaking of these numbers in a general way, without going into too many details, only the predominant or the more or less frequent distributions are indicated. In most species scattered variants differing from the usual

counts are found. Also, as will be discussed below under the subject of ontogeny, the relative numbers of branched and unbranched rays differ with the size of the fish. Consequently, accurate figures for the fully grown state are difficult to arrive at for each species. The above figures refer to the larger specimens examined and give only a roughly approximate idea of the condition in the larger adults. From the above condensed data it follows that frequently a particular species, sometimes even a particular genus, shows a characteristic distribution. In other instances variability is more pronounced. Sometimes all the segmented rays become branched late in life, as discussed below under ontogeny.

Simple Rays.—As may be gathered from Table I, there is considerable intraspecific individual variability in the number of simple rays in *Gobionellus stigmaturus*. I have not studied systematically the variation in the number of these rays in other species; because of the practical difficulty of making an accurate count, as noted above, the use of their number in the everyday practice of taxonomy is limited. Judged by their variability in *G. stigmaturus*, their number is probably not of great importance as a character in classification; but it remains to be seen whether this holds for other species also.

Asymmetry.—The data presented in Table I clearly prove the existence of a certain vertical asymmetry. The numbers of simple and of segmented but unbranched rays, in *Gobionellus stigmaturus*, average more at the upper margin than below. This kind of asymmetry was found to be general, occurring in the other species also.

The count of the simple rays in *Gobionellus stigmaturus* is symmetrical, the same above and below, in about half the specimens studied (in 21), while in the rest (in 22) the upper rays usually number 1 more, sometimes 2 more as follows: 6 and 7 both above and below in 16 and 5 specimens, respectively; 7 above and 6 below in 12; 6 above and 5 below in 7; 8 above and 7 below in 2; 7 above and 5 below in 1.

The asymmetry of the segmented and unbranched rays in the same 43 specimens is less frequent than that of the simple rays. The rays are symmetrically placed in 27 specimens; 1 above and 1 below in 12, 2 and 2 in 15. These 12 and 15 specimens have 15 and 13 branched rays, respectively. They are asymmetrical in 16; 2 above and 1 below in 9; 3 and 2 in 2; 1 and 2 in 3; 0 and 2 in 1; 0 and 1 in 1. It is to be noted that the majority of the specimens which show asymmetry in the segmented and unbranched rays have 1 such ray more above than below, 11 specimens as against 5 having 1 or 2 rays more below.

Only 14 specimens out of the 43 have both the simple and the segmented, unbranched rays symmetrical; 13 have the simple rays asymmetrical and the segmented symmetrical; 9 have both asymmetrical; 7 have the simple symmetrical and the segmented asymmetrical.

Asymmetry in the number of segmented and unbranched rays was found to differ among other species of gobies. This may be gathered from the above discussion of the intraspecific or intrageneric variability of these rays. For instance, in *Lepidogobius luculentus* and *Lythrypnus dalli* these rays are nearly always symmetrically placed in the samples studied; while in *Coryphoterus glaucofrenum* asymmetry is the nearly normal condition. Even among species extreme in this respect, variants of the opposed kind are occasionally

found, a typically symmetrical species having here and there an asymmetrical variant and vice versa. Between the extremes, there appear to be all degrees of differences among the different species with respect to the relative numbers of symmetrical and asymmetrical individuals in any particular species. For instance in the species of *Bollmannia* which are predominantly asymmetrical, frequent variants are symmetrical, and the opposite is true of *Microgobius gulosus*. In *Lepidogobius ios* symmetry is somewhat more frequent, but asymmetry is a close second. The relative numbers of symmetrical and asymmetrical individuals most probably will differ also with the size of the fish, since, as proved below, some of the unbranched rays become branched with growth. But whether the ontogenetic change produces greater symmetry or asymmetry was not definitely determined. Where asymmetry does exist, either as the nearly normal condition or as a more or less frequent individual variation, the upper margin usually has one ray more than the lower, and the variants in which the lower margin has more are comparatively much less frequent in other species than in *Gobionellus stigmaturus*, the figures for which are given above.

This vertical asymmetry, while of general biological interest, does not have much practical taxonomic value in the species studied. Most species of the same genus have approximately the same symmetrical or asymmetrical distribution; but even where they do differ, the difference only consists in the predominance of certain numbers, and there is generally too much variability to use this character in practice to distinguish congeneric species.

ONTOGENY.—The development of the segmented rays from the earliest developmental stages of the fish was not traced during this study. In a few very young fish, the smallest specimens examined of several species, all or most of the segmented rays are unbranched. However, their total number always agrees with that found in the adults of their respective species. It is evident: (1) that the rays become segmented very early in life; (2) that at first they are unbranched; (3) that for each individual the total number which are destined to be segmented according to its innate potentialities become so practically at the same time. Most segmented rays begin to branch very early in the life of the fish, each ray splitting at first into the two main limbs. This is shown in Table III for 7 specimens, 18-23 mm., of one species. The same was also found in the other species, except that the size at which this initial, almost simultaneous branching of most rays occurs, differs somewhat with the species. It tends to occur at a smaller size in species of smaller fish than in species of larger ones. This initial rapid branching apparently occurs between about 10 to 30 mm., depending on the species.

Does this process of branching cease at a certain stage of growth or does it continue throughout life? This question is answered by the data presented in Table III, which gives frequency distributions of the number of both branched and unbranched segmented rays in *Enypnias seminudus*. It is noted that the averages of the number of the unbranched rays decrease with growth, while those of the branched rays increase. It is evident that after the initial rapid branching, a much slower branching of the remainder of the unbranched rays takes place throughout life. Virtually the same results were obtained by a similar tabulation of *Lepidogobius newberryi*, *Microgobius gulosus*, and *Garmannia paradoxa*.

However, what appears to be an exception in this respect, different than in the foregoing four species, is found in *Gobionellus stigmaturus*. The 43 specimens tabulated above are 26-45 mm. long and when divided into size groups, no appreciable change with size is found in the relative numbers of unbranched and branched rays. Either the samples are insufficient to draw conclusions, or in that species the change occurs early in life and is completed or nearly so when the fish reaches a length of about 25-30 mm. Later changes may be so slow and of such minor extent as not to be detectable except by the study of large samples. The tempo of the initial, fairly rapid change during which most rays become branched as well as the much slower later change in the residual segmented rays will most probably be found to differ with the species.

TABLE III

ONTOGENETIC CHANGES WITH SIZE IN THE FREQUENCY DISTRIBUTIONS OF BRANCHED AND UNBRANCHED SEGMENTED CAUDAL RAYS OF *Enypnias seminudus*

LENGTH OF SPECIMENS IN MM.	Unbranched Rays					Branched Rays				
	Distribution				Average	Distribution				Average
	1	2	3	4		13	14	15	16	
18	..	..	..	1	4.00	1	..	..	..	13.00
23–25	..	..	6	..	3.00	..	6	..	..	14.00
26–30	..	10	15	..	2.60	..	15	10	..	14.40
31–25	2	11	12	..	2.40	..	12	11	2	14.60
36–40	11	16	4	..	1.77	..	4	16	11	15.23
41–45	7	9	1	..	1.65	..	1	9	7	15.35
46–49	5	2	..	..	1.29	..	..	2	5	15.71
51–54	6	2	..	..	1.25	..	..	2	6	15.75
59	2	..	..	..	1.00	..	..	..	2	16.00

Table III is based only on specimens having a total of 17 segmented rays, excluding the 10 variants of this species, in the composite sample studied, having 16 such rays. (Note that the two averages for each group add up to 17 and that their two frequency distributions are exactly reversed, as they should be when based on specimens having the same total number. However, the two parts of the table enumerating the branched and unbranched rays, respectively, and their averages were separately worked up from the rough data, to act as a check against each other.) Only 17-rayed specimens were included in the table in order to exclude a factor extraneous to our present purpose, that of individual variability. In basing the data only on 17-rayed individuals, the resulting figures present the change due to growth only. Individual variability, to be sure, is still involved in the data as presented. There are the precocious individuals that develop their adult characters comparatively early in life, and the retarded ones that remain juvenile at an advanced age. There are the older runts, which, when size is used as the criterion, are classed with the young; and the young fast growing ones which are classed with the older groups. There is most probably also an innate individual variability in the number of unbranched rays that remain so throughout life. However, when numbers are averaged these variabilities fail to mask

the evident steady change with growth. I prepared another table based on all the specimens, including the 10 variants mentioned, and compared it with the table here published. There is only a little difference in the averages in five of the groups. Both tables show the same progressive increase with growth in the number of branched rays and a corresponding decrease in the unbranched ones.

While the number of segmented and unbranched rays decrease with growth, patently some of them becoming branched, in most species a total of 1 to 6 of those rays evidently remain unbranched throughout life, the number differing with the species or with a predominant number of individuals of a given species as discussed above where the variability of these rays is considered. Sometimes, however, all the segmented rays become branched later in life, either as an individual variation or as a specific feature. For instance, one specimen of *Enypnias seminudus* (54 mm.) of all those examined has all the segmented rays branched. (It happens to be a 16-rayed specimen.) Such occasional variants were found in other species also, and are rather more frequently found in *Lepidogobius lepidus* and *L. y-cauda*. They are generally at or near the maximum size for their respective species. Finally, in *Eleotris pisonis* this becomes the rule. In a composite sample of 50 specimens of the latter species, those between 32 and 54 mm. all have, in addition to 13 segmented and branched rays, one upper and one lower segmented ray unbranched; all those 93 mm. or more in length have these two segmented rays branched also; while in those 60 to 92 mm. long, either one or both are branched or unbranched. Evidently the change takes place when the fish reaches the length of 60 to 92 mm.

The extent of branching also appears to increase with size, in some species at least. That is, the number of successive dichotomous forkings of each ray seem to increase, especially so in some species, as in *Eleotris pisonis*, for instance. However, this statement is based on general observation, and the extent of branching was not investigated in sufficient detail to be expressed in definite figures. It does not seem to have any valuable taxonomic significance and I did not pursue the point in a definite and systematic manner. The few rays that branch later in life, after the initial rapid process of branching, fork much less profusely than the others. This is true of *Eleotris pisonis* as well as other species.

Conclusion.—By this very simple investigation the solution of the problem becomes clear. It is now understandable why previous more or less offhand attempts to use the number of caudal rays as a taxonomic character have been often ineffective or contradictory. The two counts of the segmented rays, branched and unbranched, are mutually interdependent. Their relative numbers depend on the ordinary inherent individual variability, and also on the stage of ontogenetic development which, in its turn, depends on the size (or age) of the fish and on individual variability in the tempo of development. Consequently, when the two kinds of rays are enumerated separately, the numbers usually show considerable individual variation. Therefore, stating the counts separately, or only one of the counts, that of the branched rays, as some accounts seem to have it, gives but an incomplete and distorted picture of the morphological character of the fish. The same result is obtained by including in the count of the branched rays part of the un-

branched and segmented ones, the longer and more prominent ones, as some published accounts probably have it. On the other hand, when all the segmented rays of both kinds are counted together, the variability caused by the above factors nearly or entirely disappears. Instead of two variable counts we have one total count which is constant or nearly so. This method of counting consequently gives a true picture of the character of the fish. This happens to be also the easiest course to follow in practice. The total number does not depend on the size of the fish, and any available specimens, juveniles as well as adults, are suited for the purpose. The number may be determined with almost absolute accuracy by examination with a lens or microscope through transmitted light. When so determined this number is usually about constant for each species or even for each genus with only occasional exceptions.

Some of the counts now recorded in the literature probably include also part of the simple rays, the more prominent ones or those that are discernible at the surface without dissection. However, this study proves that the simple rays should be counted separately, not in combination with the segmented rays. Also, the number of simple rays, instead of the comparative constancy shown by the total of segmented rays, apparently shows a great deal of independent individual variability; at least this is true for the one species for which the frequency distribution was definitely determined. Consequently, this number is probably not of much importance in classification. The same will hold when all the simple rays are combined with the segmented ones into one count. The count will vary as the number of simple rays varies. The count of one or two specimens, especially, may not mean much as they may represent extreme variants of their species. Moreover, if the simple rays are enumerated at all, even though their count is given separately, it is necessary to have an absolutely accurate count, which can be accomplished only by dissection or staining. Attempts to count them as far as they may be seen on the surface without dissecting away the skin will not do. Such counts are worse than nothing at all in that they may be misleading and had better be left out altogether.

Some or all of the unbranched and segmented rays gradually become branched with growth, but the simple rays do not become segmented throughout the life of the individual. These facts of development form the underlying basis of the method here outlined. This method is especially useful owing to the surprising fact that the total number of segmented rays is relatively constant in all the genera investigated, except one. In one instance at least, the combined count proved to be a very important phylogenetic indicator, separating a number of related genera into two natural groups. Very likely the same will prove to hold in other families when the caudal fin is studied in detail according to the method indicated by this investigation.

UNITED STATES FISH AND WILDLIFE SERVICE, COLLEGE PARK, MARYLAND.

Notes on *Argentina sialis* Gilbert, an Isospondylous Fish of Western North America

By W. I. Follett

Argentina sialis was originally described by Gilbert (1890: 56–57) from *Albatross* station 3017. The locality of this station is given by Tanner (1892: 495) and by Townsend (1901: 407) as latitude 29° 54′ 30″ north, longitude 113° 01′ 00″ west. As computed from British Admiralty chart 2324, published April 9, 1879, this falls within the Gulf of California, approximately 14 nautical miles west of Cabo de Lobos, Sonora.

Thereafter the locality at which this species had been taken became confused in the literature. Goode and Bean (1895: 510) erroneously referred to it as "station 3077" (in southeastern Alaska), and added the words, "coast of California." Jordan and Evermann (1896a: 526), while repeating the original description with but minor alterations, stated the range of the species as "Coast of California." The same authors (1896b: 295) repeated this statement later in the same year and referred *Albatross* station 3017 to the "Coast of California." Meek (1916: 143) attributed *Argentina sialis* to "Californian coast, one specimen." All these references were published before Higgins (1920: 87) recorded specimens of this species from off Huntington Beach, California. It has therefore seemed desirable to verify the type-locality as published by Gilbert. An examination of the records of the U. S. National Museum has indicated, however, that the correct data were published in connection with Gilbert's original description.

So far as I have yet found, specimens of *Argentina sialis* have been definitely recorded only from the two localities previously mentioned, that is, from off Cabo de Lobos, Sonora, and from off Huntington Beach, California, although the range of the species has been given as "Coast of California" by Ulrey and Greeley (1928: 4), Ulrey (1929: 3), and Jordan, Evermann, and Clark (1930: 68), and as "Coast of southern California" by Barnhart (1936: 18). It now becomes possible to record a northerly extension of the range of this species of more than 300 miles in a general coastwise direction.

Two specimens of *Argentina sialis* (Stanford Natural History Museum Cat. No. 35311) were taken in an otter trawl by T. Ferranti on April 19, 1941, in Monterey Bay, Monterey County, California. The approximate location was latitude 36° 45′ north, longitude 121° 53′ west, as computed from U. S. Coast and Geodetic Survey chart 5403 (Monterey Bay), published November, 1926.

The larger specimen is 174 mm. in length to caudal, and 204 mm. ($8\frac{1}{32}$ inches) in total length. The latter measurement is a matter of interest in view of the fact that Gilbert's original description was based upon "A single specimen 3 inches long," while Higgins (*loc. cit.*) also refers to *Argentina sialis* as, "This little fish, about three inches long."

The smaller Monterey Bay example is 143 mm. in length to caudal and 168 mm. ($6\frac{5}{8}$ inches) in total length.

The dorsal count is ii, 8 in the larger specimen, in which both rudimentary rays are broken off. In the smaller, the dorsal count is ii, 9, the

first simple ray being small. The anal formula is ii, 12 in the larger fish and ii, 11 in the smaller, both unbranched rays being short in both specimens. Both have 17 pectoral rays on each side. The pelvic rays number 11-10 in the larger specimen and 11-11 in the smaller, not including a small curved platelet which apparently represents a (superior) half-ray and is situated at the outer base of the first main ray. Both specimens have 19 principal caudal rays, of which 10 are above the midline and 9 below. The uppermost and lowest of these are unbranched.

The gill-rakers of the larger specimen are 8 + 19 on each side. Those of the smaller are 8 + 18 on the left side and 9 + 18 on the right.

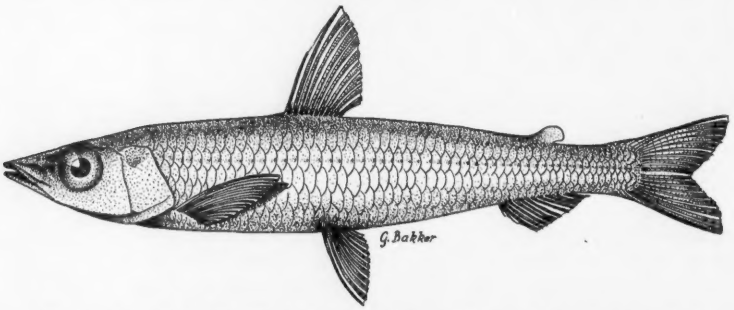

Fig. 1. *Argentina sialis* Gilbert, from a specimen 143 mm. in standard length, from Monterey Bay, California.

The vertebral count of the larger specimen, as determined by X-ray, appears to be 34 + 16 = 50, and that of the smaller, 33 + 17 = 50. The vertebra supporting the first interhaemal spine is here counted as the first caudal vertebra, without reference to the development of a complete haemal arch. In comparison, it may be noted that Chapman (1942: 115) records a vertebral count of 36 + 17 = 53 in two specimens of *Argentina sphyraena* Linnaeus from Norway.

The specimens at hand agree substantially with the data given by Hubbs (1932: 106), except that the larger has 12 principal anal rays, and in both the pelvic insertion is distinctly behind the middle of the dorsal fin, being under the 6th principal dorsal ray in both specimens.

All counts and measurements are set forth in the manner described by Hubbs and Lagler (1941: 12–20, figs. 2–3), except for the vertebral count and the manner of expressing the dorsal and anal rays. With the latter, I follow the recent usage of Schultz (1944: 179).

As there appears to be no published figure of this species, the drawing which accompanies this note (Fig. 1) was prepared by Gerhard Bakker, Jr., from the smaller of the Monterey Bay specimens.

I am indebted to Rolf L. Bolin of Stanford University for placing these specimens at my disposal; to Robert R. Miller of the U. S. National Museum for verifying the type-locality; and to Carl L. Hubbs of the University of California for assistance and advice.

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Additions to the Fish Fauna of the Philippine Islands

By Albert W. C. T. Herre

THE amazing richness and diversity of the Philippine fish fauna is forcibly illustrated by the collections made during my visit there from May to October, 1940. In various papers I have described 20 new species from my 1940 Philippine collection, and have published notes on the distribution and habits of a number of other fishes not hitherto known from the Islands. Including those mentioned in this contribution, 55 additions have been made to the known fish fauna of the Philippines from my 1940 collections in Busuanga, Mindoro, Negros, Mindanao, and Jolo.

A few of those given in this paper have been mentioned by me previously, but without definite locality; these are members of the Thunnidae, and the dolphin. The Thunnidae are common food fishes, and are so abundant that they will one day be the basis for a great canning industry in the Philippines. Most of the other fishes here listed are either little known rarities, or are remote from where they have hitherto been known.

Sardinella aurita Cuvier and Valenciennes

Ventrals with 9 rays. Differs from the more abundant *S. longiceps* in the much smaller number of gill rakers, 110 to 170 against 180 to 250 in the latter. The eye is also larger and the head shorter in *S. aurita*.

Two examples from the Iloilo market are 122 and 123 mm. in length; gill rakers 140; depth 4.9 times in the length; scales 48 to 50; scutes 19 plus 14. These specimens have lost most of their scales. Seven from Estancia, Iloilo Province, Panay, with firmly adherent silvery scales, are 99 to 111 mm. in length; sides silvery, back brown. Some have 170 gill rakers, though Regan gives 160 as the upward limit. Eleven specimens from Manila Bay at Limay, Bataan Province, Luzon, are 85 to 95 mm. in length; gill rakers 120 to 130.

In this species, as in *S. longiceps*, the number of gill rakers increases with age. This species is widely distributed in the Atlantic as well as the Pacific. It has been confused with *S. longiceps*, which is the most important Philippine sardine.

Sardinella sinensis (Day)

2 specimens, 105 and 112 mm. in length, were taken at Cagayan de Misamis, Mindanao. Gill rakers 62 on lower limb of gill arch. Depth 3.7, head 4 times in the length. Each scale on the back has a blackish spot, these spots forming longitudinal rows; a pale stripe from the upper angle of the opercle to the upper part of the caudal base, just as in Day's figure; top of the dorsal blackish, and the tips and posterior margin of the caudal black or blackish. Recorded previously from India, Amboyna, and Formosa.

Moringua macrochir Bleeker

A specimen of this rare little eel, 205 mm. long, was taken from a tide pool at Dumaguete, Oriental Negros. Previously known only from Java, the Batu Islands and the Kei Islands. Depth 47.7, the head 9.5 times in the length. The tail is 2.15 times in the head and trunk together. The length of the well developed and conspicuous pectorals is 5.3 times in the head. The distance of the anal origin from the anus is 2.1 times in the head. The color in alcohol is dark tan, somewhat dusky dorsally, with transverse streaks and spots of paler across the back. The dorsal and anal unite with the caudal to form a somewhat truncate fin, which is mottled with blackish above and below.

Evolantia microptera (Cuvier and Valenciennes)

13 specimens, 127 to 147 mm. in length, were secured from Gingoog Bay, at Barrio Cabug, Talisayan, Oriental Misamis Province, Mindanao. Most of the specimens have no barbels, or else but one; the barbels are very small and thin, not longer than the diameter of the pupil. A broad lateral band of bluish lead color extends from the upper angle of the pectoral to the caudal base. The short blackish pectorals and very short dusky ventrals are likewise distinctive. The pectorals fall far short of the ventrals. I have compared these specimens with some from the Hawaiian Islands and the Galapagos. The Philippine material is much darker, the fins more pigmented. Found throughout the tropical Pacific and Atlantic Oceans.

Cypselurus arcticeps (Günther)

Two specimens, 173 and 176 mm. in length, were caught in Gingoog Bay, at Barrio Cabug, Talisayan, Oriental Misamis Province, Mindanao. Another specimen was purchased in the market at Iloilo, but is not available for measurement. Two examples from Zamboanga are 170 and 198 mm. in length. This species is recognizable by the broad white band extending diagonally across the lower half of the black pectoral, which has a wide white or pale lower margin. The dorsal rays are 11 and 12 in two of my specimens, instead of 13 as in the published accounts. The sides of the head and base of pectorals are silvery; the pectorals are red basally, both inside and out; the cheeks are also often suffused with red; the belly is more or less golden. This is a handsome flying fish in life. Known from New Guinea, China, and Japan.

Cypselurus nigricans (Bennett)

Two specimens, 158 and 161 mm. in length, were taken from Gingoog Bay, Barrio Cabug, Talisayan, Oriental Misamis Province, Mindanao. Another of 155 mm. was collected at Margosatubig, Zamboanga Province, Mindanao. Dorsal 13 or 14; anal 9 or 10; pectoral I—13 or 14. Found in all tropical seas.

Brachypleura novae-zeelandiae Günther

Four specimens of this remarkable little flounder, 59 to 87 mm. in length, were taken by beam trawler in Manila Bay. A male 75 mm. long has the third to sixth dorsal rays elongate, extending beyond the middle of the body. First known from New Zealand, and later from Java to the south coast of New Guinea.

Aesopia cornuta Kaup

A specimen 110 mm. long was taken at Dapitan, Mindanao. The first dorsal ray is much thicker and longer than those behind it on the head and is covered with villi. Common on the coasts of India, and ranging southward to Natal, South Africa; one specimen recorded from Nagasaki, Japan.

Euryglossa macrolepis (Bleeker)

Two specimens, 119 and 173 mm. in length, from Manila Bay. The larger specimen has the depth 2.33, the head 4.55 times in the length; eye 9.5 times in the head; scales in lateral line, 65. On both specimens the scales on the posterior part of the colored side are larger than those on the head or anterior part; on the Norman's specimen the scales on the head and nape are larger than those elsewhere. This fish is evidently more variable than the published records would indicate.

Previously known only from a specimen 233 mm. long, collected at Sinkawang, west coast of Dutch Borneo, and a specimen 135 mm. long, from the coast of Orissa, India.

Cynoglossus lida (Bleeker)

A specimen 143 mm. long was purchased in the market at Iloilo, Panay, and one of 115 mm. at Dapitan, Mindanao. This tongue-fish has been known hitherto from Celebes to Natal, South Africa.

Dunckerocampus dactyliophorus (Bleeker)

Two fine examples of this rare and spectacular pipefish were taken from a coral head in a lagoon amid some isles west of Jolo, their lengths 133 and 149 mm. Color in life pale yellow, crossbarred with uniform rings of deep red; there are 8 rings on the head and snout, 22 to 24 on the trunk and tail. In alcohol the red turns darker, and the yellow ground color bleaches. Each scute ends in a prominent spine, making 6 rows of spines on the trunk and 4 on the tail. This is the most conspicuously and brightly colored pipefish.

Gymnosarda nuda (Günther)

I have taken the surf tuna several times by trolling, at the following localities:—Tailon Island, off the coast of Camarines Norte Province; off Verde Island, Verde Island Passage; Tubataha Reef, Sulu Sea; and off the coast of Leyte. Specimens taken were from 25 to 40 pounds in weight, and entirely too large for any available container. Not in Roxas and Martin's *Check List*, altho I left a specimen in the Bureau of Science collection, which was caught off Lubang Island.

Euthynnus yaito Kishinouye

An example 345 mm. long was taken at Miagao, on the south coast of Panay, Iloilo Province. Abundant in the Philippines, and one of the chief fishes packed at the Zamboanga tuna cannery. The yaito tuna is a small fish, usually 18 inches or 2 feet in length, and seldom weighs more than 8 or 10 pounds. In life the back is dark blue with numerous diagonal blackish bars and spots above, and with 3 to 5 circular spots between the pectoral and ventral fins.

Kishinoella rara (Kishinouye)

A specimen 495 mm. long was obtained at Zamboanga. This fish is also packed at the Zamboanga cannery, and is taken in large numbers along the west and south coasts of the Zamboanga Peninsula of Mindanao, around Basilan, and off the Sulu Islands, both in the Sulu Sea and the Celebes Sea. It is common in the Singapore market, and is largely packed at the tuna cannery at Si Amil Island, near Tawao, on the east coast of British North Borneo. This little tuna usually weighs from 5 to 8 pounds.

Coryphaena hippurus Linnaeus

A specimen 395 mm. long was collected at Zamboanga. Occurs throughout the Islands; at various times specimens were taken from the breakwater, Manila harbor; Malampaya Sound, west coast of Palawan; several places in the Sulu Islands; coast of Samar; Carnasa Island and Gato Island, north of Cebu, etc. Several specimens were in the Bureau of Science collection when I left the Bureau. Commonly caught by sport fishermen as well as native commercial fishermen.

Atule megalaspis (Bleeker)

A specimen 109 mm. long was taken from the Gulf of Ragay, Luzon, by a trawler. Dorsal VIII–I–23; anal II–I–22; scutes 43 on the straight part of the lateral line, the largest 6.8 times in the depth, which is 2.66 in the length; gill rakers 29. The arch of the lateral line reaches below the fourth ray of the second dorsal. Weber and deBeaufort, copying Bleeker, state the tongue is edentulous, but I find a few minute teeth on it. Known previously from Sumatra and Nias.

Caranx dinema Bleeker

An example 385 mm. long was caught at Lake Naujan, Mindoro. Dorsal VI–I–18; anal II–I–17; scutes on the straight part of the lateral line 25, the straight part beginning under the eleventh ray of the soft dorsal; gill rakers 2 plus 14, the last one very short. Head 3.5, depth 2.6, the pectoral 2.48 times in the length. The eye is 4.78 times in the head, 1.74 in the snout, and 1.45 in the interorbital width; snout 2.75 times in the head.

The color in alcohol is yellowish brown above and silvery below, with a conspicuous dark violet-brown bar at the base of each soft dorsal ray, the 12 posterior ones most evident; a violet brown spot on each side of the snout; the upper half of the soft dorsal lobe dusky brown; the outer part of the anal lobe dark brown, continued posteriorly as a submarginal anal band; ventrals dark violaceous on most of their inner surface and on the outer half of the other side; pectoral axil violet-brown, with a spot on the inner surface of the widest part of the fin.

Decapterus kurroides Bleeker

Three specimens 170 to 195 mm. in length, from Catbalogan, Samar, and one of 186 mm. from Iloilo, Panay, undoubtedly belong here. Two more, each 165 mm. long, from Catbalogan, are doubtfully admitted as they cannot be placed elsewhere. Dorsal VIII–26 or 27, plus 1; anal II–II or I–23 to 25 plus 1. Depth in a specimen 188 mm. long is 4.4, the head 3.2 times in the length; eye 3.5 in the head; gill rakers 33. Bleeker had a specimen 173 mm. long from Amboyna, and Nichols in 1942 described 3 from North Celebes, their lengths 150 to 195 mm. No others are known.

Naucrates ductor (Linnaeus)

A fine specimen 186 mm. long, from Manila Bay. Depth 3.4, head 3.4 times in the length; eye 4.46 in head and 1.5 in snout. The 4 spines of the first dorsal are connected by a blackish membrane.

Leiognathus berbis (Cuvier and Valenciennes)

Two examples, 51 and 59 mm. in length, were taken at Estancia, Iloilo Province, Panay.

Anthias albofasciatus Fowler and Bean

Two specimens, 36 and 42 mm. in length, from Puerto Galera, Mindoro. Previously known only from the type specimen, taken in the China Sea northwest of the Philippines, at 21° 54′ north latitude and 115° 42′ east longitude.

Pristipomoides typus (Bleeker)

A specimen 270 mm. long was collected at Miagao, Iloilo Province, Panay. Dorsal X–11; anal III–8; lateral line scales 48; gill rakers 4 plus 11. The body has longitudinal yellow stripes, the snout and head with alternate violet and yellow stripes; on top of the head and in the interorbital space are wavy violet cross lines. This is a good food fish.

Branchiostegus japonicus (Houttuyn)

Two specimens, 184 and 190 mm. in length, from Naujan, Mindoro.

Halichoeres javanicus (Bleeker)

27 specimens from 29 to 54 mm. in length, were collected at Dumaguete, Oriental Negros, and 42 from 28 to 60 mm., at Kolambugan, Lanao Province, Mindanao. Previously known from Java, Singapore, Ceylon, Zanzibar, and Hong Kong.

Coryzichthys gangene (Buchanan Hamilton)

A specimen 78 mm. long was taken at Capiz, Panay, and one of 38 mm. at Dumaguete, Oriental Negros.

Antennarius dorehensis Bleeker

Three examples, 33 to 39 mm. in length, were caught at Estancia, Panay. The largest has a few scattering filaments and cutaneous flaps on the chin and along the sides of the body. Bleeker had 3 specimens, 36 to 69 mm. in length, from Doreh Bay, now called Manokwari, New Guinea.

Antennarius pinniceps Cuvier and Valenciennes

Four specimens, 33 to 52 mm. in length, from Dapitan Bay, Mindanao. They are in bad condition but are typical of the species. Previously known from the Indian Ocean, and from Amboyna and Makassar in the East Indies.

Natural History Museum, Stanford University, California.

Variation in the Pacific Mud Turtle

By L. M. Seeliger

A SUPERFICIAL examination of Pacific mud turtles, *Clemmys marmorata* (Baird and Girard), from various localities readily reveals difences in external characters. The purpose of this study was to ascertain whether these differences are geographic or merely individual. Correlation of external characters with age or sex must be understood before further analysis is attempted. Most of the specimens examined in the course of the present study are in the Museum of Vertebrate Zoology of the University of California; others were from the California Academy of Sciences, Stanford University, the San Diego Society of Natural History, the private collection of L. M. Klauber, and the College of Puget Sound. Acknowledgment is made to those in charge of these collections who made the material available. In all, 158 specimens were studied; of these 138 were from California, 9 from Oregon, 6 from Lower California, 4 from Washington, and 1 from Idaho.

Measurements were made to the nearest millimeter by means of 200 mm. calipers. The length of the carapace and of the plastron was taken as the distance between the mid-anterior and mid-posterior margins of each. The external characters of specimens were compared with those given by Van Denburgh (1922: 974–976), whose description was found to be the most recent and complete. Particular attention was paid to characters that differed from his description and to those indicated as variable.

Age Variation

The condition of the surface of the plates of the carapace is correlated with the age of the specimen, assuming that the animals of similar sizes are of about the same age. The results of this comparison are shown in Figure 1. All the individuals in which the entire surfaces of the plates are granu-

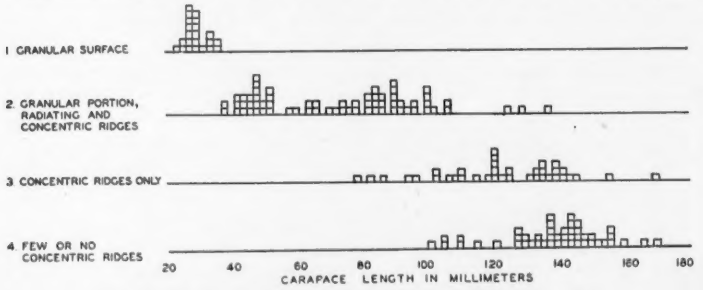

Fig. 1. Condition of the carapace surface correlated with size.

lar (stage 1) are small. These can be considered as hatchlings since the umbilical scar is still present and the shell is completely granular and soft. Stage 2 of the carapace surface (see Fig. 1) is present in larger specimens, nearly all of which have a carapace length of 40 to 100 mm.; it can be noted that the range in sizes in this group is much greater than in those of the first

stage. The relative size of the granular portion is progressively reduced with development. The radial and concentric ridges in each carapace plate vary with the size of the specimens. In the smallest individuals (carapace length 46 to 49 mm.) about two-thirds of each individual plate is granular, in those specimens about 55 mm. long the granular portion occupies about one-half of the plate, and in the larger specimens it occupies about one-fourth or less. The radial ridges are much more numerous and prominent in the smaller individuals; as the individual becomes larger, these ridges gradually become indistinct and fewer and give way to the concentric ridges.

Although there is overlapping in stages 3 (concentric ridges only) and 4 (few or no concentric ridges), it will be noted that most of the individuals in stage 4 are large whereas there is a considerable number of smaller individuals in stage 3. Some specimens with a comparatively smooth carapace have irregular holes which are probably due to wear or injury. This would suggest that these are older individuals than those not thus scarred.

In the smallest individuals, those with a granular carapace surface, the outline of the carapace is practically round whereas in the adults it is more oblong. The general appearance of both the carapace and plastral plates can be associated with this difference in shape. The individual plates of the young specimens are broader in comparison to their length, and the nuchal plate, narrow in the adults, is comparatively broad in the small specimens. The following table includes 10 typical specimens of each type of carapace surface. From it can be seen the relation of the carapace length to width in the several age groups.

	Type of carapace surface	Average length in mm.	Average width in mm.	Average width / Average length
1.	Granular	30.1	28.6	.950
2.	Granular portion and radiating and concentric ridges in each plate	67.9	56.5	.832
3.	Concentric ridges only	125.7	101.8	.810
4.	Few or no concentric ridges	145.9	114.0	.781

The tails of the smallest specimens are found to be comparatively longer and more slender than those of the adults. In only the smallest individuals (carapace length 24 to 38 mm.) is the tail relatively long. In these individuals the ratio of the tail length to the carapace length is .75 to 1.0. This relationship can be seen by examining Figure 2 which compares the ratio of the relative carapace length (carapace length: tail length) with actual carapace length. It is also shown that the tails of nearly all the adults are no shorter than those of the middle-sized groups.

In the following comparisons a specimen is considered small if the carapace length is less than 50 mm. The median dorsal ridge is present in all of the small specimens and is prominent in most of the very small individuals. A slight ridge is found in most of the adults and in a few adults it is distinct. Nearly all the adults have a definite hump at the posterior part of the carapace directly over the tail. The supracaudal plates bend upward, and there is a notch between them. None of the small specimens has this type of supracaudals but instead they are flat. The posterior part of the plastron is only weakly notched in nearly all the small specimens whereas in most of the adults it is distinctly and deeply notched.

Small and large specimens differ in coloration. As a general rule the coloration of the small individuals was found to be more consistent than that of the adults. The plastron of all small specimens with one exception (a specimen 48 mm. long) is gray or grayish brown in the center and yellow on the outside. The plastron of most of the adults is an almost solid yellow with traces of brown on the plate junctions; the brown coloring is much more prominent in some of the adults and is usually in the form of irregular brown splotches. The carapace of all the small specimens is uniform brown; more than half of these small specimens have an outer yellow margin. In some of the specimens a few black spots are evident. A few of the small specimens examined (43 to 48 mm. in length) do not have this type of coloration, but these are not the smallest individuals. The color of the carapace of most of the adults is olive or horn, with various dark markings, usually radiating marks or irregular black spots. The adults definitely have more black in the carapace than do the young.

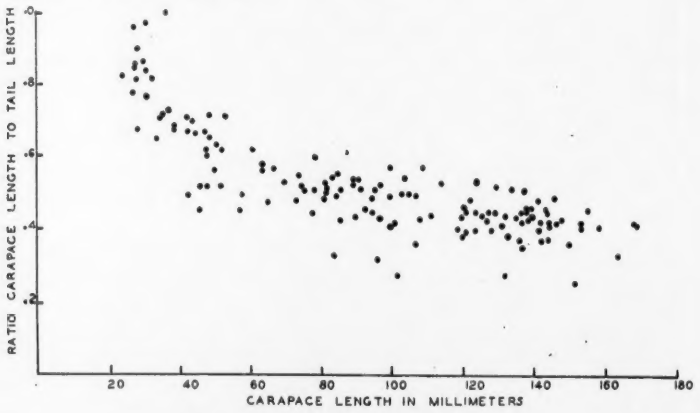

Fig. 2. Relation of tail length to size.

Smaller specimens tend to have more dark color on the top of the head than the adults. It is to be noted that this condition was found only in the smallest specimens (about 30 mm. long) whereas only a few of the somewhat larger ones (about 40 to 50 mm.) have this type of head coloration.

The coloration of the adults varies considerably; the heads of most of them are either reticulated with dark markings on a lighter yellowish olive, or are marked with light spots on a dark background or with dark spots on a light background. Longitudinal yellow stripes in a dark background or sometimes dark stripes in a yellow background are found on the chin or throat of nearly all the small specimens. The chin of most of the adults is yellow with brown spots. The under side of the limbs of most of the small specimens is yellow and a brownish or grayish color, the yellow occurring as more or less longitudinal stripes. The under surface of the limbs of the adults is yellow with brown spots. The upper surface of the limbs of both the adults and young is usually dark brown or grayish.

Sexual Differences

Male and female *Clemmys marmorata* have certain external differences. These secondary sexual characteristics are not readily distinguishable in the youngest specimens, but can be recognized in most adults. In the doubtful cases sex was determined by an examination of the internal organs.

The most evident external sexual difference was found to be the general shape of the plastron. The plastron of the male is concave, the deepest part being appproximately at the division between the abdominal and femoral plates; the plastron of the female is flat with no concavity. In about two-thirds of the sexually mature males (22 of 37 specimens examined) this concavity is deep or prominent; in the others it is present, but the degree of concavity is small. Five of the 43 females examined have a slightly concave plastron, but the general shape of the plastron is somewhat different from that of the male. Although the concavity is at about the same place as that of the males, the posterior part of the plastron has a somewhat rounded shape due to the downward slope of its extreme posterior portion.

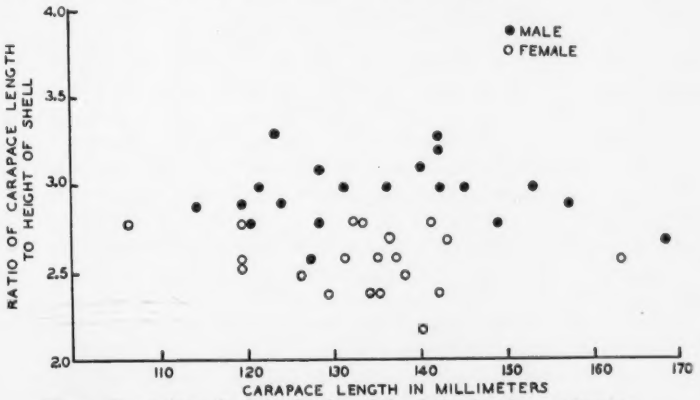

Fig. 3. Comparison of relative heights of the shells of males and females.

The anal opening of 59 per cent of the males (37 of 63 specimens) is beyond the posterior margin of the carapace; in the others this opening is only at the margin. In none of the females is the anal opening beyond the margin of the carapace. It is at the margin in 55 per cent of the females (23 of 42 specimens); in the others it is more anterior. Specimens under 50 mm. long were not considered in the above comparisons. In the male individuals with the anus beyond the carapace edge, the base of the tail is noticeably thicker than that of the females. In those in which the anus is not beyond the carapace edge the base of the tail is about like that of the females. Thus males that do not have the enlarged basal portion of the tail have the gradual tapering tail of females, whereas in males with the anus beyond the posterior carapace edge the portion of the tail beyond the anus tapers much more abruptly. Comparisons made between 57 males and 62 females reveal no correlation between sex and size, nor is there any difference between the relative tail length of males and females.

Examination of 20 adult males and 20 adult females selected at random shows that the relative height of the shells of the males tends to be less than that of the females. The average ratio of all the males was 2.97 whereas that of the females was 2.59. Some of the males, however, do have shells as high as some of the females and thus comparative height of the specimen is not a clear external criterion of sex (see Fig. 3).

No sexual differences were found in the coloration of the carapace, the plastron, or of the limbs and tail. Indications of sexual differences in the head and neck coloration were found, but these differences were not evident in all the specimens. Males tend to have a very few or no brown spots on the yellow chin or throat whereas the females have many more brown spots. The line of demarcation between the yellow coloration on the under side of the neck and the brown sides tends to be sharper in the males than in the females. The top of the head of the male usually is brown with few black spots whereas that of the female has more spots.

The following data on head and neck coloration were obtained from the adult specimens from California in the Museum of Vertebrate Zoology; the specimens considered did not show any indications of the juvenal coloration and all had a carapace length of over 50 mm. Sixty-two per cent of all the males have few or no spots on the under side of the neck, and 71 per cent of all the females have many spots. This difference may be said to be more pronounced in the specimens from the northern part of the state since 88 per cent of these males show few or no spots on the under side of the neck. The number of females with many brown spots is about the same in the northern and southern part of the state. Fifty-three per cent of the specimens with a definite line of demarcation between the yellow ventral coloration of the neck and the brown sides are males; 31 per cent of the individuals with the difference between the ventral and lateral colorations of the neck noticeable but without a definite line of demarcation are males; only 25 per cent of the individuals with no definite division at all are males. Seventy-seven per cent of the specimens having few dark spots on the top of the head are males; about the same number of males and females have a moderate number of spots; only 23 per cent of the specimens with many dark spots are males. Storer (1930: 436) found essentially the same sexual characteristics in *Clemmys marmorata* but no mention was made of color.

Individual Variation

The plates of the shell that show most individual variation are the comparatively small axillary plates, anterior to the bridge and between the carapace and plastron. In most mud turtles these are triangular, but sometimes they may be almost rectangular. These plates were found to be comparatively large, moderate, very small, or absent. No geographic correlation in the distribution of the different types of plates was found.

Several abnormalities in the carapace or plastral plates were found. Specimen No. 43581, Calif. Acad. Sci., from Siskiyou County, had very small abdominal plates that did not extend to the mid-plastral junction. There are six instead of five vertebral plates in No. 14605, from Trinity County. Specimen No. 17577, from Shasta County, had seven instead of the usual four costal plates on one side of the carapace; each of these had a distinct granular

portion. A prominent wide depressed area in the center of the plastron, extending to several of the plate junctions found in specimen No. 5099 from Mendocino County. Specimen No. 11904, San Diego Soc. Nat. Hist., had an extra abdominal plate and also a small vertebral plate.

The supracaudal plates, directly over the base of the tail, exhibit individual variation. It has already been noted that these plates are flat in young individuals. In some of the adults they curve abruptly upward and form a low hump; in others there is a less developed hump, and in a few these plates are as flat as in young specimens. No sexual or geographic correlation among the various types of supracaudals was found. Most adults have only a slight median ridge along the back, but in some it is entirely absent and in others it is prominent.

There is considerable individual variation in the coloration of mature individuals. The variations in the pattern of the carapace are striking. Dark radating lines on an olive or brown background is the predominant type of coloration, but many specimens have few markings of any kind and others have dark spots or both lines and spots. A few other color patterns, such as a dark and light reticulated pattern, or olive lines on a darker background are to be found. Individual variation in the coloration of the plastron is less marked than that of the carapace. About two-thirds of the adults have a solid yellow plastron with only a little brown on the plate junctions; in others the brown coloration is more extensive. Some individuals exhibit an irregular brown spot on each plate.

Some tendency toward sexual correlation in the coloration of the top of the head is discernible among the individual variations. Males tend to have fewer dark markings than females. In many specimens the number of spots on the top of the head produces a reticulated appearance; the majority of these are females. The coloration of the top of the head varies more than that of any other part of the animal. The ground color varies through light brown, dark brown, grayish brown, reddish brown, gray, and olive. In the majority of individuals the spots or reticulations are black or extremely dark brown, but they may be yellow, brown, olive, tan, or grayish olive. The individual variations in the coloration of the chin or throat and sides of the neck are less evident than those of the top of the head. Males tend to have fewer brown spots on the throat than females, and the line of demarcation between the browner sides of the neck and the yellow chin tends to be sharper in the males. In some specimens the sides of the neck are striped instead of spotted.

Geographic Variation

All the specimens from Oregon were from the southern or southwestern part of that state except for one from the northwestern section. The specimen from Idaho was from the southern part of the state; the Washington specimens were from the west-central section. The specimens from Lower California were taken within approximately 300 miles of the California border.

There is definite geographic variation in the form of the inguinal plate. The condition of this plate can easily be noted in the smallest specimens. There is a marked difference between the comparatively large and the small inguinals. The great majority (89 per cent) of California specimens north

of the San Francisco Bay have large inguinal plates. The exceptions are not from the extreme northern part of the state. In none of the northern specimens is the inguinal plate entirely absent. All the specimens but one from Oregon, Washington, and Idaho have comparatively large triangular inguinals. Specimens in the central inland portion of California have all

Fig. 4. California localities from which specimens have been examined.

types of inguinals. All individuals from the southern part of the state have extremely small inguinals or none at all. Specimens from near the coast south of the San Francisco Bay region have plates similar to those of the extreme southern portion of the state and are included with the southern group in the following comparisons. Sixty per cent of the southern specimens have no inguinals, in 34 per cent the inguinals are small, and in only 6 per cent are there comparatively large inguinals. Four of the six Lower California specimens have large inguinals, but they are either rectangular or round instead of triangular. One specimen has only a single large inguinal.

There is a tendency toward geographic variation in the coloration of the sides of the neck. Specimens from the northern part of California have the side of the neck brown or gray with darker spots or lines, whereas in specimens from the southern part of the state this area is yellow with brown markings. In 81 per cent of the individuals (see Fig. 5) from northern Calfiornia

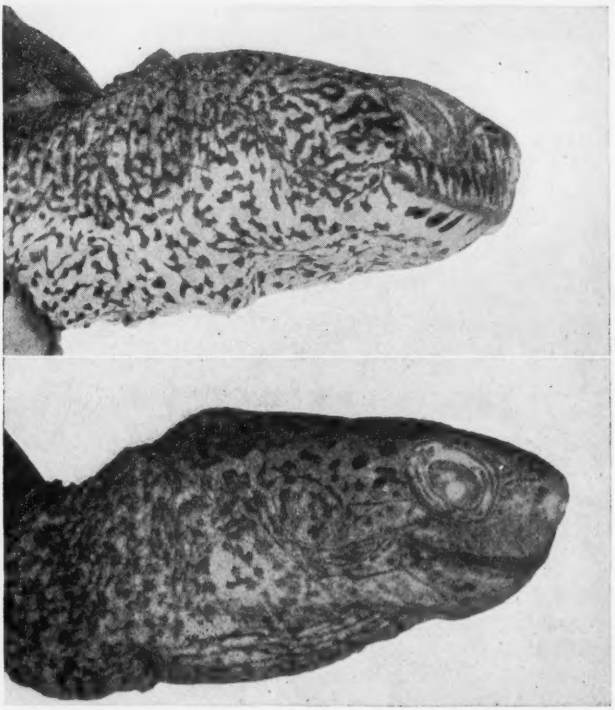

Fig. 5. Coloration of head and neck. Upper, *Clemmys marmorata marmorata* (Mus. Vert. Zool. 14602). Lower, *Clemmys marmorata pallida* (Mus. Vert. Zool. 6716).

the sides of the neck are dark. Five of the seven individuals with the light coloration are from localities near the central section of the state. Most of the specimens from the states north of California are young or poorly preserved; one specimen has the dark coloration of specimens from northern California. The specimens in the central region of intergradation have both types of coloration and neither is predominant. Seventy-seven per cent of the adult specimens from the southern part of the state have the light coloration. The few specimens from Lower California have the dark coloration which is predominant in individuals from northern California.

On the basis of the geographic differences found in this study, *Clemmys marmorata* can be divided into the following subspecies:

Clemmys marmorata marmorata (Baird and Girard)

TYPE LOCALITY.—Puget Sound.

DIAGNOSIS.—*Clemmys marmorata marmorata* can be distinguished from the southern subspecies (see beyond) by the presence of a pair of triangular inguinal plates, which usually (89 per cent) are relatively large. The sides of the neck usually are brownish or grayish with darker spots contrasting with the light color of the under side.

RANGE.—Pacific coast region from British Columbia south to San Francisco Bay; intergrades with the southern subspecies south of the Bay and in the San Joaquin Valley region.

LOCALITIES FROM WHICH SPECIMENS HAVE BEEN EXAMINED.—*Washington.*—Fort Steilacoom, Pierce Co. *Oregon.*—Keno and Klamath Falls, Klamath Co.; Willamette Valley, Clackamas Co.; Rainie Falls, Josephine Co.; Tiller, Douglas Co. *Idaho.*—Above Shoshone, Jerome Co. *California.*—Montague and Gazelle, Siskiyou Co.; Hayfork and Mad River, Trinity Co.; Ydalpom and Pit River, below mouth McCloud River, Shasta Co.; Payne's Creek and Dale's, Tehama Co.; 14 mi. N. Ukiah, Lake Leonard, and Mount Sanhedrin, Mendocino Co.; Winslow, Glenn Co.; Skaggs Springs, Duncan Mills, and Cazadero, Sonoma Co.; Calistoga, Angwin, and Conn Creek, Napa Co.; Rio Linda, Sacramento Co.; Vacaville, Solano Co.; Inverness, Marin Co.

Clemmys marmorata ***pallida,*** subsp. nov.

The name *Emys nigra* cannot be applied to this form since the type was taken on Poso Creek, Kern County, which is in the area of intergradation; *nigra* is here referred to *C. m. marmorata.* The intergrades from the San Joaquin Valley as a group fall closer to *C. m. marmorata.*

TYPE.—Adult female, No. 6716 Mus. Vert. Zool.; collected by J. E. Law on Lower Coyote Creek, near Alamitos, Orange County, California, summer of 1916 or 1917; carapace length, 134, width, 108 mm.; plastral length, 118, width, 74; axillary plates triangular; no inguinals; carapace coloration light brown with darker brown spots and radiating lines; plastron yellow with brown spots; head and neck yellow with brown spots.

DIAGNOSIS.—Inguinal plates absent (60 per cent) or small (34 per cent). The sides and ventral surface of the neck usually have a light uniform background color with dark spots.

RANGE.—Mohave River and the coastal region of southern California northward from the Mexican boundary, west of the San Joaquin Valley, to the vicinity of Monterey Bay; intergrades in the San Joaquin Valley and in the San Francisco Bay region with *Clemmys marmorata marmorata.*

LOCALITIES FROM WHICH SPECIMENS HAVE BEEN EXAMINED.—*California.*—Waddell Creek and Santa Cruz Mountains, Santa Cruz Co.; Carmel, Castroville, Mission San Antonio, and Sana, Monterey Co.; Panoche and New Idria, San Benito Co.; Nacimiento Creek and San Luis Obispo, San Luis Obispo Co.; Fillmore, Ventura Co.; Los Angeles River, Los Angeles Co.; Lower Coyote Creek, near Alamitos, Orange Co.; El Cajon, Chula Vista, San Diego, Adobe Falls, Lyons Valley, Potrero, Escondido, and Poway Corners, San Diego Co.; Yermo and Victorville, San Bernardino Co.

LOCALITIES FROM WHICH INTERGRADES HAVE BEEN EXAMINED.—*California.*—Livermore and Alameda, Alameda Co.; Lafayette, Contra Costa Co.; Palo Alto, Santa Clara Co.; Coulterville, Pleasant Valley, and Dudley, Mariposa Co.; Fresno River, Madera Co.; Friant, Trimmer Springs, Dunlap, and Mendota, Fresno Co.; north Fork Kaweah River, Sequoia National Park, Tulare Co.; Isabella, Kern Co.

Since the few specimens from Lower California are not similar to either the southern or northern forms herein defined, no attempt will be made to assign them to either subspecies.

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Influence of Availability on the Feeding Habits of the Common Garter Snake [1]

By KARL F. LAGLER and J. CLARK SALYER, II

THE common garter snake, *Thamnophis s. sirtalis* (Linnaeus), is generally known as a terrestrial animal. Our particular interest in predators on fishes has, however, led us to study this reptile in relation to the aquatic habitat. We were stimulated in this by the several specimens encountered around fish rearing establishments. At such stations, large numbers of young fish, mostly trout from advanced fry to fingerling stages, are confined in portions of natural streams or in adjacent, associated waters. Repeated observations showed that this garter snake rivals the watersnake (*Natrix s. sipedon*) as a successful fish predator under these circumstances (Lagler and Salyer, 1946). This led us in turn to the study of the garter snake in relation to fish populations in natural waters.

Our materials from Michigan have been accumulating since 1930 and at present represent eighteen fish cultural establishments and thirty-one locations on the immediate shores or banks of natural lakes, ponds, and streams away from hatcheries or rearing stations. In all, 238 specimens collected during daylight hours were examined; of these 87 contained no food. A random sample, 109 of the 151 individuals with food, averaged 644 mm. (25.4 inches) in length and ranged from 9.25 to 34.25 inches. Methods used for food analysis are the precise qualitative and quantitative ones described earlier by us (Salyer and Lagler, 1940).

[1] Contribution from the Department of Zoology of the University of Michigan and from the Institute for Fisheries Research of the Michigan Department of Conservation.

Several of our colleagues and employees of the Conservation Department contributed specimens for study. Financial help was given by the Associated Fishing Tackle Manufacturers and by the American Wildlife Institute. To these individuals and agencies and the others who have assisted us, we are very grateful.

Garter snakes collected about natural waters during summer months contain mostly terrestrial earthworms, frogs, and toads in decreasing order of probable importance; fish occur only sparingly (Table I). Of the 35 specimens from this habitat, only 3 contained fish (one also held a leech). The feeding habit in such situations, then, is predominantly related to principal animals of the marginal association, not with fishes. The earthworms eaten are terrestrial and the frogs and toads are mostly metamorphosed; this substantiates common knowledge of the land habits of this snake. In contrast to this, common watersnakes from trout streams eat more than 80 per cent fish and somewhat less than 20 per cent amphibians, whereas about lakes they consume about 50 per cent of each of these items (*op. cit.*)

TABLE I

FOOD OF COMMON GARTER SNAKES FROM ABOUT NATURAL WATERS
Based on thirty-five specimens containing 71.1 cc. of food

Food Item	Percentage of Total Volume of Food	Number of Individuals of Each Food Item	Percentage Frequency of Occurrence
Fishes	6.2	6	11.4
Frogs	23.9	12	34.3
Toads	30.8	33	8.6
Salamanders	0.7	1	2.9
Insects	0.8	7	14.3
Earthworms	35.3	50	45.7
Leeches	2.3	1	2.9
Snails	Trace	1	2.9

Annotated list of food items for Table I. FISHES: 1 trout unidentified to species; 3 brook trout (*Salvelinus f. fontinalis*), 40, 43, and 65 mm. long (average, 4.3 in.); 1 blacknose shiner (*Notropis h. heterolepis*); remains of 1 unidentified kind. FROGS: 9 *Rana* sp.; 1 pickerel frog (*R. palustris*); 1 wood frog (*R. sylvatica cantabrigensis*); and 1 leopard frog (*R. pipiens*). All frogs were of adult body form. TOADS: 33 *Bufo americanus* of which 2 were adults and 31 in one snake were just transformed or transforming. SALAMANDERS: remains of 1 unidentified individual. INSECTS: 1 grasshopper; 1 moth larva; 3 carabid and 1 scarab beetle; trace of 1 unidentified. EARTHWORMS: 50 land earthworms, Lumbricidae. LEECHES: 1 individual. SNAILS: remains of 1. VEGETABLE DEBRIS: Three snakes each contained a small amount (0.1 cc. or less) of plant material but this was apparently not taken as food.

At fish rearing stations striking differences appear in stomach contents of the garter snake (Table II). The chief foods, in decreasing order of probable importance, are: fish, frogs and toads, and earthworms. A very real response in food habits may be seen here in the shift from the natural to the artificial surroundings. Watersnakes respond similarly for at such establishments more than 95 per cent of their food is composed of fish (*op. cit.*). Also

shown is the versatility of the feeding habit of the garter snake in that it is largely terrestrial around wild waters and significantly aquatic with the increased availability of fish at rearing stations. This is concrete evidence of certain principles of food getting and population dynamics: (1) availability *is* a factor in determining food habits; (2) unusual concentrations of prey organisms invite reduction of their numbers at a temporarily increased rate even if departure from usual habit or other response on the part of the predator is involved.

TABLE II

FOOD OF THE COMMON GARTER SNAKE ABOUT FISH REARING STATIONS

Food Item	Percentage of Total Volume of Food*	Number of Individuals of Each Food Item*	Percentage Frequency of Occurrence**
Trout	40.3	115	37.9
Other fishes	2.6	4	3.4
Fish Remains	0.9	4	4.3
Frogs and toads	40.5	51***	25.0
Salamanders	0.6	2	1.7
Birds	****	2	0.9
Mammals	2.4	4	3.4
Insects	1.3	39	18.1
Earthworms	11.3	50	34.4
Snails	Trace	2	0.9
Carrion	0.1	....	2.6

* Based on one hundred snakes containing 345.5 cc. of food.
** Based on 116 snakes including the ones used for the first two columns in this table and sixteen others which were too poorly preserved for volumetric or numerical assay.
*** Does not include as individuals 250 frog eggs found in one snake.
**** Volume records and specimens lost.

Annotated list of food items for Table II. TROUT: 74 brook trout (*Salvelinus f. fontinalis*); 18 rainbow trout (*Salmo gairdnerii irideus*); 23 trout unidentified to species. Total lengths were obtained by measurement or estimated by comparison of remains with whole specimens to give an average for 108 trout of 1.84 inches, ranging from 1.13 to 3.00 inches. OTHER FISHES: 2 cyprinids; 1 tadpole madtom (*Schilbeodes mollis*), 3.25 inches long; and 1 mudminnow (*Umbra limi*). FISH REMAINS: parts of 4 unidentified fishes. FROGS AND TOADS: 8 pickerel frogs (*Rana palustris*); 4 leopard frogs (*R. pipiens*); 2 wood frogs (*R. sylvatica cantabrigensis*); 1 green frog (*R. clamitans*); 1 bullfrog (*R. catesbeiana*); 1 hylid frog; 9 unidentified frogs (*Rana* spp.); 250 frog eggs in one snake; remains of 1 individual identifiable only as frog or toad; 24 toads (*Bufo americanus*). SALAMANDERS: remains of 2 unidentified individuals. BIRDS: 2 unidentified in one snake. MAMMALS: 2 shrews (*Soricidae*); 1 meadow mouse (*Microtus p. pennsylvanicus*); 1 unidentified insectivore. INSECTS: remains of 14 unidentified land beetles of which 6 were larvae; 4 Rhyncophora; 1 elaterid; 2 carabids; 1 cerambycid; 1 damselfly; 3 ants (Formicidae); 2 mayflies; 1 moth larva; 1 dipteran; 1 grasshopper; 1 cicadellid; 2 aquatic nymphs; miscellaneous unidentified remains of 5 individuals. EARTHWORMS: 50 terrestrial lumbricids. SNAILS: remains of 2. CARRION: fleshy animal remains otherwise unidentifiable.

Because of the versatility of the feeding habits of the garter snake, implications for fish management are that it be locally controlled at fish rearing stations but that it be unmolested about natural waters. Indications are that

a fish culturist may record one dead fingerling trout for each garter snake collected at a rearing station. The number is more than double this for the common watersnake (*op. cit.*). In spite of the importance of frogs in the food of this snake, it seems improbable that the species is sufficiently numerous to affect production or yield where these figure in a fishery.

We have too few observations on the aquatic feeding habits of this snake to postulate the origin or evolution of this behavior or to compare it with the watersnakes in this regard. We believe that it is significant, however, that when an attempt is made to capture a common garter snake in the vicinity of a stream, apparently it will take to water in its efforts to escape only when all avenues by land are blocked. Preference seems to be for terrestrial escape if this is at all possible. Ribbon snakes (*Thamnophis s. sauritus*) are not so firmly entrenched in this habit since they take readily to water for escape. Moreover, they have often been found in low alders and other vegetation overhanging streams.

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Notes on Lizards from Fernando Noronha

By R. B. Finley, Jr.

THE island of Fernando Noronha, belonging to Brazil, and situated in the Atlantic some 375 miles to the northeast of Cape São Roque, is noteworthy for the presence of two distinct species of lizards. Having had the opportunity to collect specimens of these creatures, I have drawn up my notes upon their habitat and behavior. The principal accounts of the island are the papers of H. N. Ridley (1890).

The island is about 5 miles long and 2 miles broad, and is of volcanic origin. The hills, which rise several hundred feet above sea-level, are composed of angular pieces of volcanic rock embedded in reddish volcanic dust. The higher peaks have cores of solid rock. The vegetation is xeric and similar to the dry chaparral of the California coast. The ground is in some places partly bare, with scattered blocks and slabs of rock. Elsewhere it may be largely brush covered, with some dry grass. Trees grow in the ravines and other moist places. The open growth of trees consists of small cashews, with other species intermingled, and with a lower scattered growth of bushes.

Amphisbaena ridleyi Boulenger

Five specimens of the amphisbaena were collected Feb. 26, 1944, at an elevation of about 400 feet. They were obtained by turning over loose rocks. A few recent rains had reputedly marked the close of the dry season.

These lizards are burrowing and secretive. When first uncovered they seem bewildered and do not move to escape for a few moments. Then they try to burrow or crawl away quickly, hiding beneath the nearby rocks or debris. Efforts to escape are more or less haphazard, probably due to their non-functional eyes. They are easily caught by hand. The first specimen caught was allowed to crawl freely through my fingers, and soon wound around two of them with a noticeable constriction. Then it opened its mouth

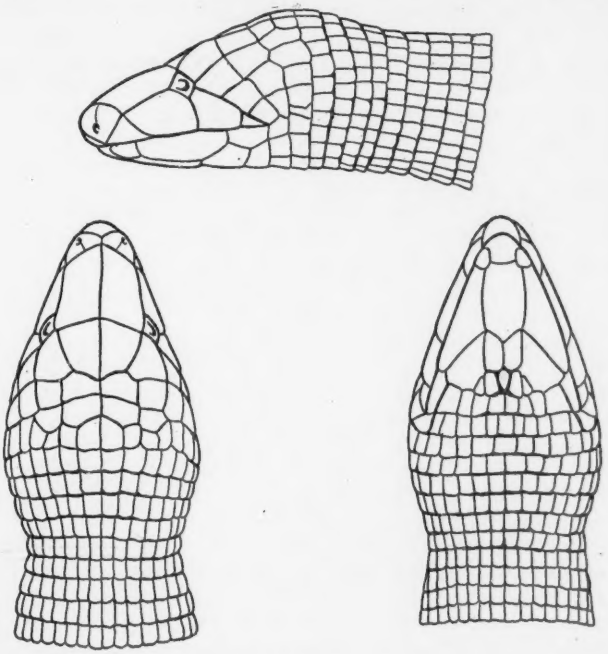

Fig. 1. Head of *Amphisbaena ridleyi*, × 3.

and clamped its teeth onto my finger with such tenacity that I only pulled it loose with considerable force. The teeth are so short that no blood appeared on my finger.

During about a week of captivity various items were offered as food. One specimen ate an earthworm. Of four or five species of millipedes, all found abundantly under the same rocks, none were eaten. A few kinds of very small beetles were also tried, and many of these were eaten. These beetles are found only sparingly under stones and leaves, but were abundant under the droppings of the cattle that wander over the island.

In coloration the live *Amphisbaena ridleyi* is dark brown above, and somewhat lighter brown below. There are no markings. The five specimens measured 183, 216, 230, 249, and 253 mm. over-all. I am indebted to Miss Peggy Collings, of the Chicago Natural History Museum, for the accompanying figures.

Mabuya atlantica[1] Schmidt

On an afternoon in November, 1943, I hiked over the hills to the southern, windward side of the island, where the skink of Fernando Noronha is very abundant. All that I saw seemed to be of the same species, but there is some variation in coloration. Three specimens were obtained on a rocky hillside, at about 200 feet elevation, exposed to the prevailing wind, which blew at about 20 m.p.h. at the time. The three specimens preserved measured 185, 211, and 211 mm. A fourth specimen, measured alive, had a total length of 248 mm., which I believe to be nearly the maximum adult size. The larger specimens were more alert and harder to catch. Most were sunning or hiding under stones. Two large specimens were seen on a rock at the very edge of a beach at the foot of a steep bank. These two were not more than 20 feet from the surf.

The lizards were extremely fast and alert. They were not very shy, but were difficult to catch when pursued. I could not catch any in the open or grassy areas, but only among scattered rocks where they could not go down deep in the crevices. They tried to bite, but ineffectively. One large specimen, caught alive and held by the tail, broke loose after much jerking and pulling, and the tail wriggled in my hand. In general, the habits and habitat of this lizard are very similar to those of *Sceloporus*.

The head shields are shiny, and the scales glossy. There appear to be three minute keels on each scale of the back and sides. The ventral scales are smooth. The coloration is mottled black or dark brown dorsally, with lighter spots of brownish, reddish, or greenish hue. Ventrally it is light grey. Different individuals vary in the lighter colors, presenting different over-all appearances of reddish, yellowish, greenish, greyish, or brownish coloration with the same dark mottled or speckled pattern. The eyelids are yellow, surrounded by a light orange or salmon-colored ring.

The dorsal parts of head, neck, and back in sunlight show a beautiful iridescent sheen when closely observed. From different angles the reflected sheen appears greenish-blue, violet, pinkish or perhaps brownish.

Ventrally, different specimens have more or less salmon color as a wash over the grey or bluish-grey background. The salmon color increases from fore to aft, being more intense on the tail just behind the vent, then decreasing slightly along the tail. The soles of the feet are a little more yellowish. On one specimen the wash covers the tail, all four legs ventrally, belly and flanks slightly and there is even a trace on the chin. On other specimens there is almost no salmon wash, except on the feet and base of tail. Perhaps this coloration may be associated with sex.

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[1] See Copeia, 1, 1945: 45, for use of this name instead of the current *punctata*.

A New Anole from Mexico

By Hobart M. Smith and Richard A. Spieler

In 1939 Edward H. Taylor and the senior author spent several days collecting in the hills above Acapulco, Guerrero. Some of the ravines in these hills are provided with extraordinarily heavy vegetation which results in a remarkable obscurity despite the glaring sunshine without. Huge boulders piled irregularly upon each other line the walls of the ravines, and provide secure hiding places for animals of many kinds. The most typical reptile was a species of anole that clung unobtrusively to the boulders, its dull colors blending almost perfectly into its dark habitat.

In recognition of the extensive support afforded by Dr. Taylor to the pursuance of field work by the senior author and his wife, we name this anole

Anolis ***taylori,*** sp. nov.

Type.—H. M. Smith Field No. 10085,[1] male, collected September 3, 1939, in the hills about one mile north of Acapulco, Guerrero, by Edward H. Taylor.

Paratypes.—Seven, 2 males and 5 females, HMS Nos. 10083-10084, 10086-10090, all collected with the type by Edward H. Taylor, Rozella B. and Hobart M. Smith.

Diagnosis.—A species of *Anolis* with absolutely smooth ventrals, granular laterals and dorsals a little smaller than ventrals; 3 to 4 enlarged supraoculars; supraocular semicircles broadly in contact, separated by 1 to 4 rows of scales from interparietal; latter considerably larger than ear opening (about 3 times, by visual estimate). Related to *gadovii* and *dunni;* differs from the latter by having larger ventrals, 7 to 8 instead of 6 scales between nasals, 5 or 6 rows of loreals instead of 4, etc.; differs from *gadovii* in many characters, particularly in having 2 instead of 3 or 4 rows of gulars in contact with mental between chin-shields, supraorbital semicircles in contact with canthals instead of separated by one or two rows of small scales, 6 to 9 instead of 10 to 12 scales across snout between second canthals, etc.

Description of Type.—Head moderately elongate; frontal ridges well defined, enclosing a distinct concavity; scales in internasal and postnasal area small, keeled; other dorsal head scales smooth or slightly rugose; three azygous, enlarged scales in the frontonasal area; frontonasal and prefrontals relatively large, flat; six scales across snout between the middle of the second canthal scales (*i.e.,* second from ocular region); seven canthals, the anterior in contact with the first supralabial, second largest, others decreasing in size anteriorly; nasal in contact with first supralabial; six postrostrals, extending from one supralabial to the other across the snout; supraorbital semicircles broadly in contact with each other and with second canthals; two rows of small scales in the small area between supraorbital semicircles, first canthal and supraorbital disk; 3-4 enlarged supraoculars, separated from median head scales by 1-2 rows on one side, 0-1 on the other, and from the first superciliary by a minimum of 2 rows; two rows of scales between interparietal and supraorbital semicircles; 6 rows of loreals; 3-5 large suboculars; 6-7 supralabials to a point below middle of eye, 3 in contact with suboculars.

1 All specimens are in the 1938–1939 Walter Rathbone Bacon Collection, property of the U. S. National Museum, whose permanent numbers are not yet assigned.

Six infralabials to a point below middle of eye; mental split medially into two equal scales, its labial border about one-half greater than that of rostral; some seven chinshields, the first the largest, the others greatly decreasing in size posteriorly; two rows of small scales between anterior chinshields, in contact with mental; one row of sublabials anteriorly, two posteriorly; anterior sublabial in contact with anterior chinshield, wedged between the latter and the first infralabial.

Ear opening about one half as long as deep (vertically), measuring 1.6 mm. x .6 mm.; area of ear opening about one-fifth that of the interparietal (2.5 mm. x 2 mm.).

Dorsal scales small, keeled, becoming gradually larger medially, the two median rows slightly larger than others and about 4 to 5 times as large as the average median lateral scales; ventrals absolutely smooth, rather irregular in size, the dimensions of an average scale exceeding those of the largest dorsals by about one fourth of the latter; preanal scales somewhat convex but not keeled.

Postanals somewhat enlarged; basal subcaudals smooth, other tail scales keeled; the two median ventral scale rows composed of very large scales, one per segment; two smaller lateral scales and 1½ dorsal scales per segment.

Dorsal and anterodorsal scales of upper foreleg relatively large, keeled, nearly equal in size to the large, keeled scales on the anterior face of the lower foreleg; lamellar formula for finger 10-18-26-26-20 (9-19-25-25-21), and 7 or 8 lamellae on the terminal phalanx of each digit.

Anterior scales on thigh enlarged and keeled, gradually becoming smaller and smooth on the ventral surface, abruptly becoming very much smaller on the posterior dorsal surface; scales on shank very small middorsally, becoming abruptly larger both anteriorly and posteriorly, and again slightly smaller midventrally; lamellar formula for toes 9-17-25-38-30 (9-16-24-37-27); 7 or 8 lamellae on each terminal phalanx; 19-19 lamellae under the second and third phalanges of the fourth toe.[2]

Dorsal surface light brownish gray, a little darker laterally; a distinct white stripe extending from subocular region onto the neck, immediately above the axilla, and disappearing midway between axilla and groin; a dim, brownish band across supraorbital disks; limbs with irregular lighter marks. Ventral surfaces of head, throat and chest heavily stippled with black, those of posterior parts very little stippled; dewlap described in life as "dark wine color, with three dim maroon bands radiating from a central area at middle of attachment to body; light blue lines following the dewlap scale rows."

VARIATION.—Only one adult male, the type, is available. A subadult male (No. 10083) is marked like the type except for having a broad, broken, light brown streak above the lateral white line. Females are uniform gray-brown, with an emphasis upon the gray laterally, upon the brown medially. The entire ventral surfaces are immaculate or very sparsely stippled in females. A very small male (No. 10089), measuring 31 mm. in body length, shows almost as extensive a pigmentation of the gular region as the larger males. The largest female measures 58 mm. from snout to vent.

The lamellae on the fourth toe (see footnote above) vary from 17 to 20.

[2] These lamellae are counted from the middle of the joint between the first and second phalanx to the end of the expanded pad, which actually involves the proximal end of the fourth phalanx as well as all of the third.

The loreal rows are 6-6 except in one specimen with 5-5. The scales between the second canthals range from 6 to 8. The supraoculars are 4-4 in five specimens, 3-3 in two, and 3-4 in one. The rows of scales between the supraoculars and superciliaries vary from 2 to 4, and between the supraoculars and supraorbital semicircles from 1 to 3. The scales between the occipital and the semicircles vary from 1 to 4. The semicircles are in contact in all specimens. The supralabials to the middle of the eye usually 7, vary from 5 to 7.

The form of the anterior gulars, between the anterior chinshields, is a character of considerable importance. In all specimens of *taylori* the anterior chinshields are relatively close together midventrally, and are separated by two rows of small gulars. Four rows, occasionally (one specimen in 25) reduced to 3 immediately back of the mental, separate them in *gadovii*. *A. dunni*, it may be mentioned, resembles *taylori* in this character.

Comparisons.—This species is closely related to *Anolis gadovii*, which occurs commonly at Tierra Colorada, some 50 miles to the north. We have had available a series of 25 specimens, on which data were taken, from that locality. The latter species differs from *A. taylori* in having (1) smaller scales on the snout, varying in number from 10 to 12 in a transverse line between the middle of the second canthal [8] (6 to 9 in *taylori*); (2) at least one complete row of small scales separating supralabials from suboculars, occasionally one supralabial in contact with suboculars (always two to four supralabials in contact with suboculars in *taylori*); (3) smaller supraoculars which are separated by a minimum of 3 rows of small scales from the superciliaries and by usually 2 rows on both sides (68.7%) from the supraorbital semicircles; (4) supraorbital semicircles separated (one exception only, in 25 specimens) from canthals by 1 or 2 rows of small scales (in contact in *taylori*); (5) two or three loreal scales (one on one side in two specimens) in contact with first supralabial (only one in *taylori*); (6) sublabials reaching only second chinshield in 60% (first in 94% of *taylori*); (7) chinshields smaller, the anterior separated from each other by 3 or 4 series of scales immediately behind mental (2 in *taylori*); (8) ear larger, about half or more the area of the interparietal (about one-fourth in *taylori*); (9) largest scales on upper foreleg not over half size of largest scales on lower foreleg (nearly equal in *taylori*); (10) middorsal scales on shank enlarged somewhat at a point about midway between the ends of the shank (all very small in *taylori*); (11) largest dorsal scales not over about twice the size of the average median lateral scales (about 4 times as large as laterals in *taylori*); (12) adult males with a characteristic reticulated pattern on back and sides (adult males in *taylori* uniform dull, light, gray-brown except for a bright, white stripe extending from the sides of the head halfway to the groin); and (13) females very densely stippled with black on all ventral surfaces (very little in females of *taylori*). There is also an average difference in number of lamellae on the fourth toe.

The only other close relative of *taylori* is *A. dunni*, a species of the Sierra Madre del Sur some 70 miles to the north of Acapulco. In the latter species, of which we have available one recently collected specimen, the head scales are still larger than in *taylori*, particularly in the anterior snout region; there are only 6 between the nasals and 5 in contact with the rostral between

[8] Counting the first canthal as that which borders the superciliaries.

the supralabials (7 to 8, and 6, respectively, in *taylori*); loreal rows 4 (6 in *taylori*, one specimen with 5); ventrals distinctly and dorsals somewhat larger; and the dewlap is "reddish" (dark wine color with light blue streaks along the scale rows in *taylori*).

REMARKS.—A distinct group of species in Mexico is formed by *dunni*, *gadovii* and *taylori*. All have absolutely smooth ventrals, 3 or 4 enlarged supraoculars, the supraorbital semicircles in contact, small dorsals about one-half or one-third the size of the ventrals, a large interparietal, and an ear opening of moderate size. No other Mexican species possesses these characters.

These three species occupy distinct physiographic areas in southern Guerrero. *A. taylori* inhabits the coastal range isolated at least in part by the strongly semi-arid valley of the Río Papagayo from the humid foothills (near Tierra Colorada) inhabited by *gadovii*. *A dunni* occupies still higher territory in the Sierra Madre del Sur.

A. taylori and *gadovii* occupy much the same sort of habitat, differing mostly in the density of the vegetation. Both live on huge boulders, but the valleys about Tierra Colorada where *A. gadovii* occurs are relatively open and the boulders are mostly in plain sight.[4] Where *taylori* was found the boulders are not seen except by penetrating the forest. *A. dunni* differs from both other forms in habitat preference, occurring on the trunks of pine trees.

The evidence at hand supports the consideration of *dunni* and *taylori* as somewhat parallel derivatives from *gadovii*, which may thus be regarded as the most primitive of the group.

BIOLOGICAL LABORATORIES, UNIVERSITY OF ROCHESTER, ROCHESTER, NEW YORK.

4 The habitat of this species has received special comment by Mosauer, 1936 (*Herpetologica*, 1: 61-63).

Herpetological Notes

EMORY'S TURTLE IN THE VIRGIN RIVER DRAINAGE OF NORTHWESTERN ARIZONA.—A female Emory's turtle (*Amyda emoryi*) was taken in northwestern Mohave County, Arizona, in the Virgin River drainage, February 10, 1945. It was caught on a fish hook in the clear water at Lewis Bottom by a schoolboy from Mesquite, Nevada. The Lewis Bottom slough, fed by a clear spring, is in the bed of the Virgin River about 1½ miles upstream from Mesquite, Clark County, Nevada, across the state line in Arizona.

The living turtle (carapace length 198 mm.) was first brought to the biology room of the Virgin Valley High School at Bunkerville, Nevada, and then presented to the Biology Department of Dixie Junior College at Saint George, Utah. It matches very well specimens of *Amyda emoryi* in the senior writer's collection.

A soft-shelled turtle (species not named) has been reported from the Boulder Dam region and from Pierce's Ferry on the Colorado River by Cowles and Bogert (1936, Herpetologica 1(2): 42). The present record seems to be the first for the Virgin River and for the area, which is over 100 miles northeast of previously reported localities.—ROSS HARDY, *Dixie Junior College, Saint George, Utah*, and LEE LAMOREAUX, *Biology Department, Virgin Valley High School, Bunkerville, Nevada*.

BIRTH OF A BROOD OF *CROTALUS BASILISCUS*.—On May 3, 1944, Barrett Park Zoo, on Staten Island, New York, received a large female Mexican West Coast rattlesnake, *Crotalus basiliscus* Cope. Her length was approximately 1550 mm. At 9:00 A.M. on July 7, 1944, 29 offspring were discovered in her cage, two still in their membranes. One soon freed itself but the other died while only part way out of its membrane.

At 9:00 A.M., when the young were first noticed, the mother had begun to shed, and was about one-fourth out of her old skin. By 2:00 P.M. she had completed shedding, and soon after gave birth to the thirtieth and last offspring. Four atrophied eggs with a rubbery covering and filled with yellow, viscous fluid were also discharged.

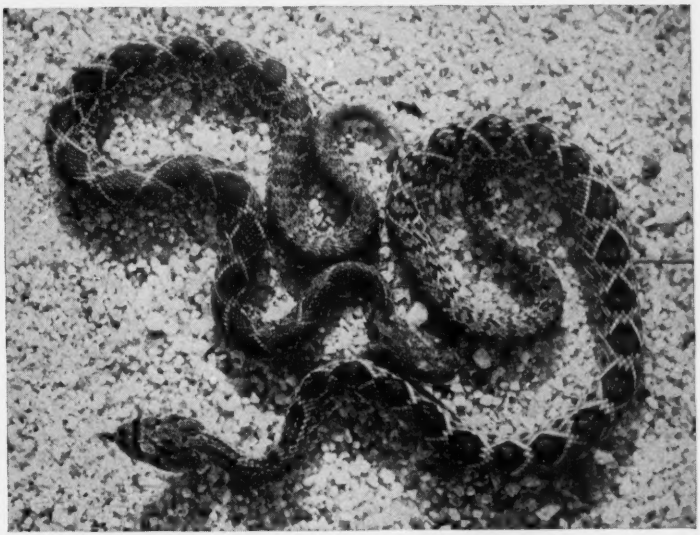


Fig. 1. Two juvenile *Crotalus basiliscus*. The upper one has not yet shed, while the lower one has recently completed shedding.

Three of the juvenile snakes were approximately 317 mm., 322 mm., and 330 mm. long, the dead ones measured 300 mm. and 310 mm., and the average length for the five was 315 mm. The pattern resembled the mother's, although in some the diamonds on the back tended to unite in the neck region to form a median dorsal longitudinal band. In several there were paired dorso-lateral bands on the neck, somewhat like those of *Crotalus durissus*. The ground color was gray and the diamonds were dark gray, almost black.

The young were quiet throughout the first day and moved about very little. They were not nervous and made no attempt to strike when annoyed, although they tried to turn and bite when held by the neck.

On the second day, after removal of the mother, there was more activity among the young snakes. Several vibrated their tails when annoyed, though only one could be induced to strike. One died at 5:00 P.M. on the second day.

Although their eyes had been cloudy since the first day, no shedding took place until the afternoon of the fourth day. All had completed their first shedding by July 14. Shedding the skin changed the ground color from gray to greenish-yellow and brought out the pattern with brilliance. The diamonds became a dark lustrous brown. Each diamond contained smaller paired diamonds in its center, pale greenish-yellow in color, which were not present before shedding. After shedding the snakes became more active and were more inclined to vibrate their tails and to strike when annoyed.

When shedding was completed, mice and hairless baby rats were placed in the cage. The mice were readily killed and eaten but only one of the ten baby rats was taken. The snakes struck vigorously at the mice, sometimes clinging long enough for a mouse to make several jumps. Death from these "good bites" followed in about 30 seconds. All mice that were observed being eaten were taken head first. All but three of the baby rattlers ate, although eight subsequently regurgitated this food. The mother refused to eat from the time of her arrival until July 31, 24 days after the birth, when she ate a guinea pig.

On August 4, all but one of the young rattlesnakes ate mice; none ate baby rats, which were also offered.

On August 1 the 28 remaining babies were measured. The longest was 396 mm., the shortest 340 mm., and the average length 366 mm. On August 30 they were again measured. The longest was 450 mm., the shortest 375 mm., and the average 404 mm. Comparing this figure to the average length of the five measured at birth shows roughly an average growth of 89 mm. in 55 days.—DONALD MARCY, *Staten Island Zoological Society, Staten Island, New York.*

NESTING OF THE TWO-LINED SALAMANDER ON THE COASTAL PLAIN.—There is a scarcity of records of the two-lined salamander, *Eurycea bislineata bislineata* (Green), from the Atlantic coastal plain, and most observations of its behavior have been made either in the north or in upland situations. The following notes were made at Shackelford Farms, near Lanexa, New Kent County, Virginia. New Kent County lies well within the coastal plain, about 30 miles east of Richmond, between the Pamunkey and the Chickahominy rivers. Most of the county is under 100 feet in altitude. The upper coastal plain terraces are deeply eroded into steep-sided ravines that are covered with mixed pine and hardwood forests. Since the slopes are of heavy clay with marl outcrops, the small streams draining them are mud bottomed and rich in lime. There was no gravel or rock in the streams examined, only sticks, leaves and other organic debris.

Two nests were found April 21, 1944. Laying presumably started sometime during that week as this same stream had been examined a week earlier, with negative results. Both nests were in a small stream that varied from 1 to 2 feet in width and from 1 to 3 inches in depth, with but a slight current. One nest was in a submerged tangle of roots on the under side of a clump of mosses and plants growing on the edge of the stream. A small irregular cavity, free of mud and soil, had been formed in the tangle of roots. The eggs were attached singly to the fine roots that formed the sides and top of the nest. When the nest was exposed the salamander was seen with the eggs, but she escaped by retreating farther under the bank. Forty-two eggs were counted without destroying the nest and in the roots there may have been a few more that were not seen. The clump of weeds and moss was turned back in place, and the site left undisturbed for about an hour. I then revisited it and found the salamander returned to the nest.

The second nest was in a submerged drift of leaves in the center of the brook, in water about 3 inches deep. The nest cavity was destroyed in exposing the nest, and all that could be seen were the eggs and the salamander with them. The eggs were attached singly to portions of several leaves and small twigs. Forty-five eggs were counted.

Each egg is enclosed in an ovoid envelope, which is attached to the leaf or twig by its smaller end. The point of attachment is relatively wide, approximately 2 mm. in diameter. While the capsules are sufficiently flexible to allow each egg some individual movement in the current, they will not stretch and even when washed in a strong current, they never took the form of a stalk or thread.

Only two nests were seen although a number of similar places were examined. There are numerous logs, sticks, and pieces of wood of various sizes in the stream, but no eggs were found under them. Two males were found in a small dam formed by two pieces of wood.

Other salamanders associated with *Eurycea* in the stream were *Desmognathus fuscus fuscus* and larval specimens of *Eurycea, Desmognathus* and *Pseudotriton.*

Four adult *Eurycea* (CM 22724–7), two males and two females, were collected and deposited in the Carnegie Museum, Pittsburgh, Pa.—NEIL D. RICHMOND, *Shackelford Farms, Lanexa, Virginia.*

TYPE LOCALITIES OF TWO AMERICAN TURTLES.—The type locality of *Chrysemys picta picta* (Schneider), 1783, is "Unknown, said to have been England" (Stejneger and Barbour, 1943: 203). The history of this species is representative of that of many of the forms described by classical authors. The species was well known for many years prior to its description by Schneider; Seba (1734: 129, pl. 80, fig. 5) gives a fairly good figure and description of it under the name *Testudo ex Nova Hispania,* and mentions that the Portuguese know it as the "Kagado d' Agao." Peter Brown (1776: 116, pl. 48, figs. 1–2), in his *New Illustrations of Zoology,* gives an excellent figure of a juvenile specimen, and calls it the "cinereous tortoise"; Brown's specimen was in the cabinet of one Richard Green, apothecary, of Litchfield (or Lichfield), Stafford County, England. Several writers discussed the Brownian species, but none went so far as to give it a characterization acceptable in the modern sense, nor gave it a specific name, until Schneider, with somewhat more mature specimens at hand from the cabinet of Bloch, described the species as *Testudo picta.* The provenance of Schneider's specimens was unknown, but their similarity to the Brownian specimens was obvious, hence Schneider's postulate as to their hypothetical origin in England. Actually, the distribution of the species in North America was fairly common knowledge, and certainly not unknown to Schneider.

From the time of its original description until reviewed by Johann David Schoepf (Historia Testudinum; Naturgeschichte der Schildkröten: 1792), the species really received barely more than nominal mention. By virtue of his minute redescription, discussion, and his excellent illustration, Schoepf qualifies as the first reviser of the form. In any event, he was the first writer to discuss the species with a personal knowledge of it in its native habitat, and he states clearly that it is a native of North America, and well known to him. Schoepf says further that the specimens from which he has taken his description and illustration were sent to him after his return to Erlangen, by his friend Heinrich Muhlenberg, who caught them in his millpond in Lancaster, Pennsylvania. It is suggested that the type locality of this species be therefore restricted to Lancaster, Pennsylvania.

The status of *Clemmys guttata* (Schneider), 1792, is very similar to that of *Chrysemys picta picta,* for its type locality is also "unknown." In this instance, Schoepf, in addition to again qualifying as first reviser, was the collector of his own specimens, and states that he took them in May, 1778, near Philadelphia (where he was stationed as surgeon to a regiment of Hessians). His specimens were apparently the first to be made known from a specific geographic locality. It is therefore suggested that the type locality of *Clemmys guttata* be restricted to the vicinity of Philadelphia.—M. B. MITTLEMAN, *470 Pelham Road, New Rochelle, New York.*

NOTES ON CAPTIVE SLOWWORMS.—On May 11, 1945, the writer collected an adult slowworm, *Anguis fragilis* Linnaeus, in a dry flowerbed at Thomasroith, Austria. This lizard measured 12.3 inches in length and was in perfect condition with a normal tail of approximately 4 inches. On May 17 a second specimen with the same body size, but with a renewed tail growth of 1.5 inches, was captured in a spruce forest one mile west of Reischach, Germany.

Both individuals were capable of rapid movement and wriggled violently when first handled. They made no attempt to bite, but often turned and pressed their snouts forcibly into the palm. The strength of these lizards is considerable. When held in the hand, the general "feel" of the body is similar to that of a constricting snake, and both body and tail were often wrapped around the fingers of the writer in a very tight hold for so small a reptile. When supported by the tail alone, the lizard with the normal appendage had little trouble in elevating its body and holding it in any aerial position; the specimen which had previously practiced autotomy was not as capable in this respect.

They would not tolerate being held by the neck alone. When this was done they twisted the entire body much in the manner of coral snakes (*Micrurus* sp.) until the writer thought their necks would snap under pressure. It is possible that this is a behavior trait common to many burrowing reptiles.—RICHARD C. SNYDER, *94th Chemical Mortar Bn., A.P.O. 229, New York, N.Y.*

A THIRD RECORD OF THE SONORAN BOX TURTLE.—In the autumn of 1941, Prof. Ira L. Wiggins, Director of the Natural History Museum of Stanford University, brought home a strange box turtle obtained during a botanical excursion in Sonora. Examination showed that the beast probably belonged to an undescribed form, but my approaching departure for South America made it impossible to pursue the matter further. Upon my return, I found awaiting me Bogert's description of *Terrapene klauberi* (1943, Amer. Mus. Novit., No. 1226: 2), based on four females from Rancho Guirocoba, about 18 miles southeast of Alamos, southeastern Sonora, and in it I recognized Prof. Wiggins' turtle. More recently, Bogert and Oliver (1945, Bull. Amer. Mus. Nat. Hist., 83, art. 6: 397–398) record two more examples from Alamos itself.

Wiggins' specimen (Stanford 10770), a fine adult female, extends the known range of *T. klauberi* northward approximately halfway to the United States border. The locality is the Sierra de Batuc, about 8 km. northeast of Matape, Sonora, on the road between Matape and Batuc. Batuc is not shown on the Sonora sheet (Provisional edition, 1937) of the American Geographical Society's Millionth Map of Hispanic America. It is a small place on the west side of the Rio Moctezuma, about 11 km. north of the junction of the Rio Moctezuma and the Rio Bavispe that forms the Rio Yaqui. The locality where the turtle was collected is on the western slope, among rolling granitic hills, with volcanic intrusions, covered with desert scrub. The turtle was abroad in the late afternoon. The nearest stream was about one-quarter mile away.

In this specimen the fourth vertebral is about a millimeter shorter than the first. The plastron has as much black as Bogert's paratype No. 63752, but with almost no trace of the light spots. The straight-line length of the carapace is 136 mm.—GEORGE S. MYERS, *Natural History Museum, Stanford University, California.*

A NOTE ON THE GREAT BASIN TIGER SALAMANDER.—During February, 1943, I was sent several medium-sized specimens (length 110 mm.), of the Great Basin tiger salamander, *Ambystoma tigrinum nebulosum* Hallowell, from the south rim of the Grand Canyon, Arizona, through the kindness of Dr. H. C. Bryant. Two thrived and grew on a diet of earthworms, sow bugs, centipedes and beetles. When live food was not at hand they were given raw and cooked meat or fish. They had their preferences; they did not like "Spam" but were eager for bits of liver or beef. In a short time they became conditioned to taking food held above them by means of fingers or forceps. They had to be fed in this way, but retained some of their primitive activities. When their box was opened they would often jump as high as they could and snap their jaws. Sometimes they would seize each other, then the one bitten would very actively turn over and over until free, much like alligators in similar circumstances. When they seized their food they would often shake it as though it was making active resistance, even when they had a small bit of meat or fish. For months they would eat every time food was presented until they were so full they could scarcely move, but after two years they do not take as much. They have grown to about twice the length they were and show slight differences in size and coloring. One is evidently a male, the other a female with some sexual differences marked which were not seen before. October 10, 1944, they were 220 mm. long with very thick heavy bodies and thick tails. In May, 1945, they were 220 and 230 mm. in length.—WILLIAM A. HILTON, *Dept. Zoology, Pomona College, California.*

PILOT BLACK SNAKE ATTACKS MAN.—The note, "Black Snake Attacks Boy," (COPEIA, 1944: 257), prompts me to describe the belligerent action of a 92-inch pilot blacksnake (*Elaphe obsoleta obsoleta*) captured near Beavertown (Snyder County), Pennsylvania, early in June, 1939, and placed on exhibition there. On the day of capture, I placed the snake in a hardware-cloth case on my porch, which fronted the main street; a small sign near the cage gave the name of the snake and some pertinent facts about it. Regardless of my instructions, some persons who came to view the snake prodded it; and after striking the sides of the cage it developed an open wound on the end of its snout. After three days, I decided to liberate it near a small stream a few miles south of Beavertown. I carried the snake in the cage across about 75 yards of closely grazed pasture and released it in thick vegetation near the stream. I started back to my car and as I climbed up onto the highway, I sensed some movement behind me. I turned to see my recent captive advancing rapidly toward me. I backed up to the car and stood

still but the snake came on and struck at me repeatedly. Several of the strokes were strong enough to be felt above my knees through heavy whipcord breeches. Twice the snake struck at the front fender of the car, and the sound was as audible as one made by placing the hand flat onto the fender and snapping the middle finger down with force. I recaptured this fighter and carried it back to the place where I had released it. This time I backed away rapidly and it followed me for about 20 yards. I stopped and it stopped; after a few seconds it turned and retreated back into the heavy forbs and brush between the pasture and the stream, where I left it.—DOUGLAS E. WADE, *Naturalist in Residence, Dartmouth College, Hanover, New Hampshire.*

NOTES ON THE SNAKES OF SOUTHEASTERN ALABAMA.—From April 9 to September 29, 1944, I was stationed at Camp Rucker, Alabama, and during this period there were frequent opportunities to observe and collect the snakes of the region. The following notes apply roughly to the triangular area formed by the town of Ozark, Dale County, Dothan, Houston County, and Enterprise, Coffee County. For the most part they comprise the Camp Rucker Military Reservation in northern Dale County. They are intended as an annotated addition to the work of Loding (1922, Geol. Surv. Ala., Paper No. 5), Holt (1925, COPEIA, 136: 100–101), and Haltom (1931, Ala. Mus. Nat. Hist., Paper No. 11).

The frequently observed water snakes (*Natrix*) are omitted from the list as specimens were not collected. Perhaps the most notable omission is the genus *Thamnophis;* no species of this genus was seen during my stay.

During my stay at Camp Rucker, I came upon a heterogeneous collection of preserved reptiles bearing only the label "From Camp Rucker" in an unused dispensary. These reptiles had been collected in the area by an Army surgeon stationed there during the preceding year. Three probable records are from this source.

Farancia abacura abacura (Holbrook).—Loding indicates that this snake is common on the coast and records specimens from Mobile and Tuscaloosa counties. On June 2, a soldier brought in a half-grown *Farancia,* collected in grass at the top of a deep gully. This gully leads into a wet, sandy swamp 400 yards away, and in dry weather its banks are baked to a brick-like hardness that no snake could penetrate. There had been steady rain for the preceding two days, and evidently this snake had wandered a considerable distance from its natural habitat.

Diadophis punctatus punctatus (Linnaeus).—Loding records this snake from Mobile, Baldwin, Tuscaloosa and Lawrence counties, while Holt lists it from Autauga. On May 7, I found one inside a rotting log near Enterprise. This was the sole specimen seen although several efforts were made to collect a series.

Heterodon simus (Linnaeus).—Loding and Holt note this species from Baldwin and Autauga counties respectively, while Haltom includes Mobile and Tuscaloosa. On June 25, a 16-inch specimen was found DOR in Ozark and two 8-inch young were found preserved in alcohol in the unused dispensary.

Opheodrys aestivus (Linnaeus).—Holt and Loding record this species from Etowah, Jefferson, Tuscaloosa, Montgomery, Mobile and Autauga counties. On July 3, a fast moving specimen was seen in the top of a bushy hedgerow in Camp Rucker. It was the only green snake seen throughout the summer.

Coluber constrictor constrictor (Linnaeus).—This snake is exceedingly common throughout in open or brushy country. On one day in mid-August seven individuals were seen over an area of 2 square miles and two were collected by turning over boards.

Coluber flagellum flagellum (Shaw).—This snake was observed and collected about as frequently as the preceding species.

Elaphe obsoleta confinis (Baird and Girard).—With the exception of the two preceding species, this snake was the commonest in the area. Its favored habitat is open woods or wild, overgrown meadows and it was often collected from trees at heights of from 5 to 30 feet.

Lampropeltis getulus getulus (Linnaeus).—Loding records this snake from Talladega and Baldwin counties. On July 12, a 3-foot female, very brightly colored, was found nearly buried in a rodent burrow along the Rucker-Enterprise highway in Coffee County.

Cemophora coccinea (Blumenbach).—Loding records this species from Limestone, Tuscaloosa and Mobile counties, and Holt adds Montgomery. The writer collected a

specimen beneath the bark of a rotting pine log near Ozark on September 2nd. A second record from Camp Rucker is a preserved specimen collected from the Camp by members of the staff of the post surgeon and exhibited as a coral snake (*Micrurus*).

Storeria occipitomaculata occipitomaculata (Storer).—One small specimen bearing the sole data "Camp Rucker, Ala." was found in the unused dispensary collection.

Haldea striatula (Linnaeus).—Loding records this snake from Mobile and Baldwin counties. On June 21, the writer collected an 8-inch specimen moving about in moist sand on a hill overgrown with blackberry (*Rubus*) and young pine near Ozark. There was almost no cover nearby save small flakes of pine bark.

Tantilla coronata coronata Baird and Girard.—Loding notes this species from Baldwin and Mobile counties; Haltom adds Tuscaloosa. On May 1, the writer collected a 10-inch specimen by splitting open a rotten log. The locality was a moist, heavily wooded slope one mile southeast of Ozark. No further specimens were found in a prolonged search of several hours or on subsequent days.

Micrurus fulvius fulvius (Linnaeus).—Loding and Haltom record this snake from Etowah, Greene, Tuscaloosa, Mobile and Baldwin counties and Holt adds Autauga. On July 31, the writer identified a specimen killed by a soldier near Dothan. Other substantiated reports indicate that several have been killed on the reservation. One speciman bearing the data "Camp Rucker" was taken from the dispensary collection.

Agkistrodon piscivorus piscivorus (Lacépède).—Fairly common in swamps adjoining streams and in all the larger waterways. Persistent reports of killed copperheads traced to the specimens by the writer invariably proved to be *piscivorus*.

Sistrurus miliarius barbouri Gloyd.—Loding records this species from Tuscaloosa, Houston, Mobile and Baldwin counties, while Holt adds Shelby and Autauga. Two juvenile specimens bearing the data "Camp Rucker" were found in the dispensary collection.

Crotalus adamanteus Beauvois.—Loding reported this snake to be rare in Mobile and Baldwin counties. From its general range on the southeastern coastal plain, it should occur in the lower portions of all southern Alabama counties.

I collected this rattlesnake in Coffee County near Enterprise and throughout Dale County. It is the commonest poisonous snake of the region. Three were killed in Houston County during the summer. Scarcely a week passed without reports of rattlesnakes being killed and investigation proved all to be of this species. It was usually met with in wild brush country, but on September 12, fourteen *adamanteus* were killed by members of the 66th Infantry in a clearing in open, dry woods. This clearing resulted from lumbering operations in 1942 and was well filled with logs, mostly longleaf pine. All the snakes were of good size, the largest measuring 5 feet 11 inches and the smallest 2 feet 9 inches.—RICHARD C. SNYDER, *94th Chemical Mortar Bn., A.P.O. 229, New York, N.Y.*

UNUSUAL BEHAVIOR OF *CNEMIDOPHORUS SEXLINEATUS*.—In July, 1944, a letter was received from the junior author, containing a number of observations made in North Carolina while receiving military training there. Among these one of especial interest concerns a specimen of *Cnemidophorus sexlineatus* voluntarily concealing itself beneath rocks submerged in water. A search of the literature reveals no record of similar behavior in this species.

The observation was made at a locality, 15 miles north of Durham, North Carolina, on July 6, 1944, and the specimen was collected. The junior author's field notes are quoted below:

"While walking along the bank of the stream, I approached within 5 or 6 feet of what sounded like a lizard scurrying through the dry leaves; however, its agility made it impossible to observe. Then the creature, apparently aware of my approach, was seen as it jumped about 2 feet into the stream, where it took shelter, submerged in water, beneath a rock near the opposite bank. I carefully lifted one rock and could see only its tail; upon elevating another rock, I observed the whole body of a *Cnemidophorus sexlineatus* and promptly caught and preserved the specimen."—LAWRENCE S. DILLON and RICHARD J. BALDAUF, *Reading Public Museum and Art Gallery, Reading, Pennsylvania.*

THE NORTHERN RANGE OF BERLANDIER'S TORTOISE.—Stejneger and Barbour (1943, A check list of North American amphibians and reptiles) give the range of *Gopherus berlandieri* Agassiz as from the southwestern corner of Texas into northeastern Mexico. Strecker (Baylor Bull., 18(4): 14) reports this tortoise from near San Antonio and from Live Oak County. San Antonio is 200 miles north and Live Oak County is 125 miles north of the type locality, the lower Rio Grande, Texas. Strecker (*loc. cit.*) also states that it has been recorded from Brownsville by Dr. True. He says further that the Baylor Museum has a young specimen from Jefferson County, which is at the very southeast corner of the state. This account is undoubtedly confused for Berlandier's tortoise does not occur naturally in Jefferson County or any other part of east Texas. According to Pope (Turtles of the United States and Canada, 1939), the species is found in Atascosa County and near San Antonio (Bexar County), southward to Tamaulipas, Mexico. Atascosa County is adjacent to Bexar County on the south. Dr. J. C. Cross, of the College of Arts and Industries, Kingsville, Texas, writes me that this species is common enough to be troublesome to gardeners around Kingsville, Kleberg County. He has observed mating in the late summer and early fall. He sent me a specimen on April 29, 1944. Hamilton, (COPEIA, 1944: 62) reports seeing sixteen specimens in August, 1938, in San Patricio County, 30 miles north of Kingsville.

Thus Berlandier's tortoise ranges more widely northward and eastward than is generally known, and has had such a range for many years. On the other hand, the question of a possible northward and eastward spread of this species must be considered. In 1923 a specimen of this tortoise was caught in Refugio County, near Bayside. According to Mr. Ben Earp, it was considered to be such a rarity that his father purchased it, paying a price of $5.00. Mr. Earp says he has seen eight or ten specimens in Refugio and Aransas counties during the ensuing years, five of them during the past two years.

On April 1, 1944, I took a specimen in Refugio County on the short peninsula between Copano Bay and the east side of Mission Bay. This is 150 miles north-northeast of the lower Rio Grande. That was the first knowledge I had that the species was to be found in this region. Apparently, it is much rarer in Refugio and Aransas counties than at Kingsville, 60 miles to the southwest. The point at which the tortoise was taken in Refugio County is 50 miles east of Live Oak County, where Strecker reported the animal, and 40 miles east of the point where Hamilton recorded it from San Patricio County.

Mr. H. B. Parks, of the State Apicultural Research Laboratory, San Antonio, writes me that tourists bring many Berlandier's tortoises from the south. He said that often the tortoise "is thrown out far north of his home." Be that as it may, it appears that Berlandier's tortoise now occurs naturally over several thousand square miles of South Texas, bounded roughly on the north by San Antonio and on the east by Refugio County.

The flora and fauna of south Texas have changed considerably since about 1880 and a northward and eastward expansion of some species from the border region has taken place. The armadillo has moved from south and central Texas to beyond the Mississippi River during the last fifty or sixty years. The chaparral cock or roadrunner lags not far behind and has been recently recorded from eastern Louisiana. The south Texas tall grass prairie has been covered to a large extent by mesquite and other brush. This information was summarized by Price and Gunter (1943, Proc. and Trans. Texas Acad. Sci., 26: 138–156). The appearance of Berlandier's tortoise in Refugio and Aransas counties within the last twenty years indicates that it, too, is moving northward and eastward from the lower Texas border region. Future records should be of interest in this respect.—GORDON GUNTER, *The University of Texas, Rockport, Texas.*

EARLY SPRING MATING OF THE WOOD TURTLE.—On March 26, 1945, in a small brook near Wilton, Conn., I noted a wood turtle, *Clemmys insculpta* (Leconte), closely pursuing another of the same species. As the water was clear and shallow it was easy to capture them and to observe that one was a male and the other a female, the latter being the smaller. Upon release the animals resumed their interest in each other. Most of the time, the male followed the female, but on at least two occasions, when the male stopped pursuing the female, she turned about, tipped him up from the bottom and crawled under him.

I soon discovered in the immediate vicinity a second male, as large as the first, but

I did not observe the two males pursuing the female at the same time. In fact, I am not sure that both males engaged in this courting.

At the time of this observation, I did not know that turtles ever mated under water. Clifford H. Pope, in his *Turtles of the United States and Canada*, mentions only one observation of this kind for the wood turtle, an under-water mating observed by Albert H. Wright.

It is of interest that Pope records matings in New York and New Jersey "during May or the latter part of April." The mating here recorded, approximately a month earlier, was observed during an unusually early warm weather period.—CLYDE FISHER, *The American Museum of Natural History, New York 24, New York.*

AN ARTERIAL ANOMALY IN THE MARINE TOAD.—In 1935 O'Donoghue (Jour. Anat. London, 70: 159–176) described from an otherwise normal male *Rana temporaria* an abnormal left subclavian artery, which originated from the aorta just posterolateral to the coeliaco-mesenteric artery, passed forward and parallel with the left aortic arch until it reached its normal level, and then turned laterad to the arm in which it had a typical distribution. No similar anomaly had been recorded from the Salientia. A similar condition was recently found in the marine toad, *Bufo marinus* Linnaeus. I have seen this anomaly only once in over 600 specimens examined. Other instructors here state that a case or two of a similar abnormality were noted in the several thousands of toads examined by them. The plausible explanation of the abnormality upon palingenetic grounds makes it an interesting one.

The specimen here described is apparently normal in all respects except for the abnormal right subclavian artery. The general course of the arterial system of *B. marinus* is similar to that of the Indian toad (*B. melanostictus*) described and illustrated by Bhaduri (1930, Jour. Asiat. Soc. Bengal, N. S., 26: 301–315). The arteries of the left aortic arch branch normally, the subclavian artery arising from the external border of the systemic arch immediately behind the occipito-vertebral artery. The right aortic arch, however, does not give rise to a subclavian branch. The subclavian artery of this side arises from the aorta just below the aortic origin. From this point of origin the subclavian passes anteriorly parallel and dorsal to the right systemic arch as far as its external border, where it turns abruptly laterad and passes outward along the brachial nerve. In a similar case noted previously, the diameter of the systemic arch on the abnormal side was greatly reduced from the point of origin of the occipito-vertebral artery to the dorsal aorta.

Embryologists concur that the subclavian arteries, which supply blood to the pectoral limb rudiments, are derived from certain lateral, somatic intersegmental branches of the aorta and systemic arches. During the course of evolution the limbs shifted along the side of the body and received their blood supply from successive intersegmental arteries, i.e., from the intersegmental arteries most directly opposite the limb. The implication of this fact, together with the knowledge that the subclavian artery is derived from different intersegmental arteries in different groups of higher vertebrates, is that an imperfect repetition of this process occurs during ontogeny. In view of the facts that the archetypal amphibian arterial system is closely approached in the Caudata, in which the subclavians stem from the dorsal aorta near its origin, and that in the Salientia and all higher vertebrates the subclavian arteries are apparently displaced up the aorta on to the systemic arches, the anomaly here described seems to represent the retention of a palingenetic vessel. This explanation agrees in part with O'Donoghue (*op. cit.*), who stated that the cause must be sought on phylogenetic, not ontogenetic grounds. The term caenogenetic should be substituted for ontogenetic in this connection because the connotations of "phylogenetic" and "ontogenetic" become somewhat nebulous during the developmental process, and elements of both phenomena seem prominent in the atavism mentioned. Apparently the abnormal subclavian arteries in both *R. temporaria* and *B. marinus* failed to undergo the transition from one intersegmental artery to another during the displacement craniad, with the persistence of the original intersegmental artery, which arose from the dorsal aorta to supply the limb rudiment.—ROBERT W. HIATT, *Department of Zoology and Entomology, University of Hawaii, Honolulu, T. H.*

LOCAL POPULATIONS OF LIZARDS AND SNAKES.—During the course of mammalogical work I spent a large portion of five months, October, 1939, to March, 1940, along the Colorado River in the vicinity of the Laguna Dam, Potholes, Imperial County, California. Through the courtesy of the Dam's caretaker, Mr. William Ayres, I camped and collected on a small point or island, which separates the take-off of the main Imperial Valley canal from the Colorado River proper.

This spit of land, saved from complete insularity only by a few yards of plank bridge, is perhaps 400 yards long and from 20 to 30 yards wide (distances are estimated, no accurate map being available). In observable respects this island differs little from the adjacent California river bank. Fundamentally it is solid rock and massed boulders overlaid with a mixture of sand, gravel and smaller rocks. Aside from a little cottonwood grove at the lower end, and an old alfalfa patch, the vegetation is largely cane (*Echinochloa*), willow, arrow weed (*Pluchea sericea*), mesquite, and catclaw.

October 3, 1939, I took a single adult *Leptotyphlops humilis cahuilae* under a heavy plank in moist leaf mold beneath the cottonwoods. Spasmodic reptile hunting and stone turning during the winter yielded several specimens of *Sonora miniata linearis*, but no more *Leptotyphlops*. During this period from October to February I was able to devote only a short time each day to reptile collecting. Early in February I began to find the ground snakes in considerable abundance, and on February 20, another *Leptotyphlops* was secured. In about four hours of collecting, in the next few days, I took 17 worm snakes and approximately 70 *Sonora*.

Both kinds of snakes were taken in the same situations, usually within 6 inches of the surface in a loose mixture of sand, gravel and small stones. In the early morning specimens were found close to the surface on exposed flats and small banks. Towards noon we had better collecting in the damper ground under arrow weed and mesquite. Our procedure was to rake over the loose soil, turning larger stones individually. *Leptotyphlops* was often found in groups of three individuals, usually two adults and a juvenile. I was unfortunately unable to determine the sex of the specimens.

After working the island rather thoroughly, we turned our attention to the adjacent and similar California shore, where most hard work over a large area yielded no snakes.

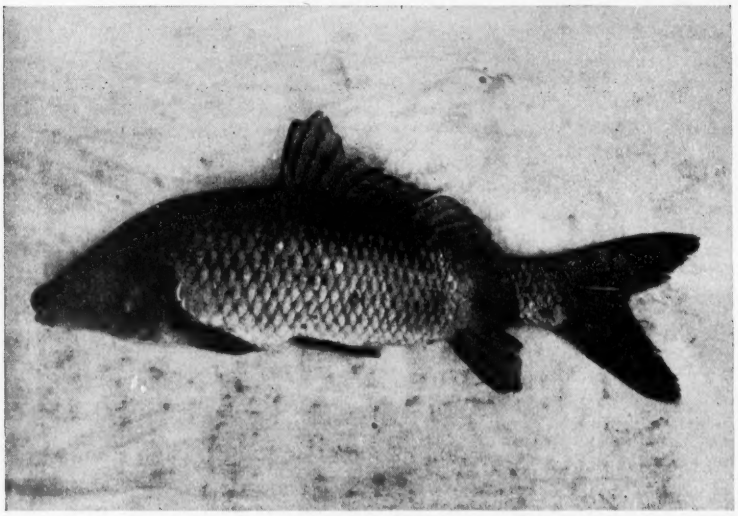
In another respect the island is very interesting herpetologically. On the California shore, *Uta ornata* was exceedingly scarce. I observed only three individuals on the mainland. On the other hand, *Uta stansburiana* was ubiquitous. On the island, *stansburiana* was almost absent, while *ornata* was exceedingly abundant. On cottonwood trunks near camp I counted 51 individuals, visible at one time, and secured a picture showing over 20. They were active in good weather all winter. After lunch I often rested an hour or so in the tent and amused myself watching the antics of these lizards, which scurried up and down the tent walls. Observing these silhouettes was fascinating. In stalking flies, the lizards would ignore those alighting more than 7 or 8 inches away. First sign of attracted attention was a slow twitching of the long tail tip, continued until the last 2 inches of a careful stalk, then increasing rapidly in tempo as the lizard came to a full stop. The capture was made with a final lightning rush. If the quarry was missed, the whole incident passed off with a slow jerking of the tail, surprisingly like a gesture of disgust.

On the island we secured also *Rana pipiens, Coleonyx variegatus, Uta stansburiana, Cnemidophorus t. tessellatus, Lampropeltis getulus yumensis, Masticophis flagellum frenatum*.—WALLACE F. WOOD, *Oakland, California*.

Ichthyological Notes

ABNORMAL FIN CONFIGURATION IN A CARP.—The specimen of carp shown in the accompanying photograph was taken in July, 1944, by commercial fishermen in a lake in Minnesota, and was brought to the attention of the writer in a fish market. It is about 15 inches in total length. Except for fin structure, it apparently is normal in every respect.

Superficially, as shown by the photograph, there appears to be a continuous fin all the way from the origin of the dorsal to that of the anal. More exactly, however, both the dorsal fin and the anal fin are normally inserted anteriorly, but bend around onto the left side of the body posteriorly. A supernumerary fin fragment is smoothly attached to each of these fins near (about 3 or 4 fins rays from) the posterior end, giving the appearance of a single continuous fin band. The fin ray count is: dorsal, I, 19; anal, I, 5; and the accessory fin, 7 rays.



The portions of the dorsal and anal fins which lie along the side of the body, and the supernumerary fin fragment, are firmly attached to the body. Dissection and X-ray reveal that each ray of the extra fin portion has a sort of basal element, which lies loosely in the flesh and has no connection with vertebrae or other bony structure. The rays enter the skin between scales; the normal scale pattern and the lateral line are comparatively little disturbed.

The specimen has been examined critically by Dr. R. K. Meyer, of the Biology Department, University of Wisconsin, and Dr. John D. Black, of the Wisconsin Conservation Department. The X-ray examination was made through the courtesy of Dr. O. A. Mortensen, of the University of Wisconsin.—JOHN GREENBANK, *Wisconsin Conservation Department, Madison, Wisconsin.*

Reviews and Comments

SOUTH AMERICA CALLED THEM; EXPLORATIONS OF THE GREAT NATURALISTS: LA CONDAMINE, HUMBOLDT, DARWIN, SPRUCE. By Victor Wolfgang von Hagen. Knopf, New York, 1945: xii + 311 + ix, 28 illus. $3.75.—The author of this work, with its rich prose and vivid enthusiasm for the tropical scene and for the history of scientific exploration in South America has undergone no small evolution of his own since his first trip to Mexico twenty-odd years ago. The reviewer encountered him during a still earlier career in Chicago when he was a bookbinder with a flair for the esoteric (he bound books in human skin for the lunatic fringe of the medical profession) and with a treatment for the decaying bindings of old books. His interest in old books has been maintained throughout his subsequent career, whether in Mexico or Quito or London, and is reflected in the present work in the excellent choice of contemporary illustration for the successive chapters.

Mr. Hagen has chosen the stories of four of the genuinely great scientific explorers of the South American continent for a retelling enlivened with imagined conversation, embellished with singularly well-chosen quotation, and then woven into a tapestry on the fabric of his own knowledge. The author's first hand acquaintance with the plateau of Quito brought him into contact with the survey of La Condamine and the mountain measuring of Von Humboldt. His stay on the Galapagos Islands forms his background for the appreciation of Darwin's memorable visit to these islands at one of the ends of the world. And his knowledge of the Amazonian slopes of the Andes and of the forest Indians serves him in good stead in his description of Madam Godin's all but incredible journey and in his understanding of the toils and perils undergone by Richard Spruce.

How directly Von Humboldt was the intellectual ancestor of Darwin is well set forth. The exact and instrumental observations of La Condamine in the elementary field of physical geography were elaborated into exactness of method for all geographic exploration by Von Humboldt. Von Humboldt's geographic researches blossomed in the enquiring mind of Darwin into the evolutionary synthesis. Spruce, less significant to the history of science than the other three, richly deserves the juxtaposition with them as one of the truly great scientific pioneers on the South American continent. Spruce's "Notes of a botanist on the Amazon and the Andes," which appeared long after his death, edited by the sympathetic and friendly Alfred Russell Wallace, merits the renewed attention focussed on it in the present book.

The illustration of these great stories with contemporary prints and portraits, and with maps, is extremely satisfactory and the chronology, bibliography, and index are adequate.—Karl P. Schmidt, *Chicago Natural History Museum, Chicago, Illinois.*

THE PACIFIC WORLD. Edited by Fairfield Osborn. W. W. Norton & Company, New York, 1944: 208, several maps, plates, figs. $3.00.—The American Committee for International Wildlife Protection, initiated and sponsored this book, "believing that literature regarding the animal life of the Pacific islands would encourage its conservation." The authors have attempted to present a general picture of the Pacific basin which would give a clearer idea, to those in the armed forces, of this part of the globe that seems destined to become the center of our attention in the future. The title of the book is much more inclusive than its subject matter. It would be more accurate to call it "The Pacific Islands"; for the coasts of the mainlands bordering the Pacific have been neglected in the treatment. This, I think, is too bad, at least from the viewpoint of conservation, since many of the marine animals, tunas and whales, for examples, seem to be transoceanic, spending part of their lives along our coast as well as around the tropical islands. Nevertheless, the book makes a fascinating evening's reading.—L. A. Walford, *Stanford University, California.*

SPORT FISHING IN HAWAII. By Edward Y. Hosaka. Bond's, Honolulu, 1944: i–ix, 1–192, 148 figs.—This is a good practical handbook, containing a lot of the kind of information an angler needs, only a few pictures of sportsmen standing beside their catch (there ought to be a law against such) and no flowery descriptions of the joys of angling. The first half of the book, on fishing technique, has the ring of authority coming from long intimate experience. The second half deals briefly with the more important of the Hawaiian game fishes. For each species there is a figure, a description, and notes on distribution, habits, food, fishing methods, and edible qualities. There is a key, a glossary, and an abstract of Hawaiian fishing laws.—L. A. WALFORD, *Stanford University, California.*

THE FISH GATE. By Michael Graham. Faber and Faber, London, England. 2nd Ed. 1943: 192 pp., several figs.—As relatively minor as the fisheries may be when compared with other industries, they are nevertheless an important lead into the national economy. This is the theme of Michael Graham, and explains his title: "The Fish Gate" was one of the many entrances into the City of Jerusalem. Here a fishery biologist of long experience and distinguished accomplishments, in a homely, sympathetic way discusses the history of the sea fisheries and the nature of the problems which have beset them in recent years. In the same way he tells how the biologists have developed the knowledge for solving these problems. More of this kind of literature is sorely needed for explaining to the public the means of getting the most of its fishery resources.—L. A. WALFORD, *Stanford University, California.*

NEW ENGLAND'S FISHING INDUSTRY. By Edward A. Ackerman. University of Chicago Press, Chicago, Illinois, 1941: xix + 303, illus. $4.00.—"A book for geographers, economists, fishermen and fish merchants, *marine biologists,* and maritime historians; written with a verve and pace which make good reading . . ." The quotation is from the jacket blurb, but the italics are mine. Ichthyologists and fisheries administrators should also find the book good reading.

It is a well rounded account of all phases of New England's commercial fisheries, not purely an economic treatise, as the name might suggest. For instance, the fishing grounds are well described and 20 charts show the principal grounds for as many species of fish and shellfish. One chapter is devoted to gear and vessels, a subject that has been generally neglected since G. Brown Goode's great work on the fisheries industries of the United States, published 60 years ago. Other chapters cover locational factors of fisheries and related industries, marketing areas and handling, the economic division of the industry and the social aspects of New England fisheries. Emphasis is often given to recent trends in New England fisheries and changes in the social structure brought on by modern methods at sea and ashore. Each chapter is followed by an ample list of good references.—OSGOOD R. SMITH, *U. S. Fish and Wildlife Service, Stanford University, California.*

THE BRITISH COLUMBIA FISHERIES. By W. A. Carrothers. The University of Toronto Press, Toronto, Canada, 1941: i–xii, 1–133.—The purpose of this book is to provide material for an understanding of the problems of the fisheries of the Pacific coast, which followed efforts to apply administrative machinery developed from Atlantic coast experience. The Pacific coast fisheries differed sharply in character from the Atlantic fisheries with the result that machinery effective for the latter was found to be inadequate for the former. The history of the several fisheries and the administration of them is recounted and documented in numerous pertinent tables.—L. A. WALFORD, *Stanford University, California.*

DRYING AND DEHYDRATION OF FOODS. By Harry W. Von Loesecke. Reinhold Publishing Corporation, New York, 1943: 277 pp., 64 figs. $4.25.—This is a compilation of the most recent information on dehydration. The scope of the book includes fish, as well as most other classes of foods. A special feature is a partial list of patents pertaining to the subject. The book is well documented with references and tabular data, and strikes a high standard of practicability.—L. A. WALFORD, *Stanford University, California.*

REGIONAL GEOGRAPHY OF ANGLO-AMERICA. By C. Langdon White and Edwin J. Foxcue. Prentice-Hall, Inc., New York, 1943: i–xxii, 1–879, 287 figs. $4.75.—Geography has long been studied according to *sections*, which are associated with the artificial lines drawn by politicians. This book presents the subject according to *regions*, which are characterized by uniformity of resources. The difference between these two points of view is fundamental to rational governmental planning and intelligent thinking by the citizenry. One of the reasons why fisheries maagement has not yet reached its full potentiality in this country is that it is attempted on a sectional (i.e., state) rather than a regional (interstate) basis. "Regional Geography of Anglo-America" is excellent. It is authoritative, discriminately illustrated, and concise.—L. A. WALFORD, *Stanford University, California.*

THE BOOK OF NATURALISTS: AN ANTHOLOGY OF THE BEST NATURAL HISTORY. By William Beebe. Alfred A. Knopf, New York, 1944: i–xiv, 1–495. $3.50.—That nature can be described artfully as well as truthfully is well demonstrated by this collection of pieces beginning with examples of Stone Age cave paintings and ending with Rachel Carson's beautiful essay on the migration of the eel. The representation, among the authors, by such distinguished scientists as Carl Linnaeus, Charles Darwin, William Morton Wheeler, and Julian Huxley, well demonstrates that scientists need not confine themselves to such stuffy writing as characterizes present day literature of "pure" science.—L. A. WALFORD, *Stanford University, California.*

THE CHEMISTRY AND TECHNOLOGY OF FOODS AND FOOD PRODUCTS. Edited by Morris B. Jacobs. Interscience Publishers, Inc., New York. Vol. II, 1944: i–xx, 1–833, 66 figs. $10.50.—This volume (see COPEIA, 1944, for a review of Volume I) describes the machinery and its operation involved in the handling, preparation and preservation of foods and food products; also the control of quality and sanitary standards. It is a general review, dealing chiefly with principles applying to many classes of foods.

The technology of fishery products is touched upon briefly. The book is excellently indexed. A third volume, containing a comprehensive bibliography, would add materially to the value of the work.—L. A. WALFORD, *Stanford University, California.*

EDITORIAL NOTES AND NEWS

Honor Roll

CHANGES in and additions to the list of Society members in the U. S. war services are: SGT. DAVID BIERHORST, U. S. Navy; PVT. JAMES M. BOYLES, U. S. Maritime Service; LT. NORMAN H. V. ELLIOTT, U. S. Army; CPL. J. B. FUNDERBERG, U. S. Army; CPL. EDWARD GAUSE, Army Air Corps; LT. JOHN D. GOODMAN, Army Medical Corps; PVT. SAM E. HALL, JR., U. S. Army; T/5 RICHARD M. JOHNSON, U. S. Army; GEORGE MARTIN KRISE, JR., U. S. Marine Corps; PFC. JOHN G. LYON, U. S. Marine Corps; LT. ROBERT P. OWEN, U. S. Army; LT. C. W. REID, U. S. Navy; PVT. JAMES S. NAGLER, Army Air Corps; LT. NORMAN WILIMOVSKY, U. S. Army.

News Notes

A LETTER from L. D. BRONGERSMA in Leiden, addressed to DR. THOMAS BARBOUR and ARTHUR LOVERIDGE, reports that the museum in Leiden suffered little damage to its collections and no loss of staff, though one staff member was interned in Germany for a year, and Dr. Brongersma himself narrowly escaped arrest, if not death, for his connection with the underground in the Netherlands. His letter, reporting the damage to the Dubois paleontological collection, and the trials to which science and scientists were subjected in this country by the war, has been forwarded to *Museum News*.

Latest word just in from England states that Mr. Norman's position at the BRITISH MUSEUM remains unfilled. "The chief worry in ichthyological circles here is lack of personnel. Hardly any young men have been trained in biology in the past five years; we have lost several by death, and expansion in fisheries research will make new demands."

DR. HUBBS has received word that DR. CANUTO MANUEL, ichthyologist of the Philippine Bureau of Science, is alive and well.

DR. LEO S. BERG, Honorary Foreign Member of the Society, after three years evacuation in Kazakhstan, is now working again at the Museum of Zoology, Academy of Sciences, in Leningrad. He is engaged in preparing the fourth enlarged and revised edition of his "Poissons des eaux douces de l'U.S.S.R." The curators of the Academy are DR. A. N. SVETOVIDOV, DR. G. L. LINDBERG, and DR. A. P. ANDRIEAHEV. PROF. G. V. NIKOLSKY is working at the Moscow University, PROF. I. F. PRAVDIN at the Leningrad University. DR. P. J. SCHMIDT intends to move to Moscow. DR. A. TARANETS fell at the front.

DR. ROBERT C. STEBBINS has been appointed assistant curator, in charge of the herpetological collections, in the Museum of Vertebrate Zoology, University of California.

DR. LOUIS A. KRUMHOLZ, since 1940 Junior Aquatic Biologist with the Institute for Fisheries Research, Michigan Department of Conservation, Ann Arbor, has resigned to accept a position as Instructor in the Department of Zoology, Indiana University, Bloomington. Dr. Krumholz will be engaged in research in the expanding program of the Indiana Lake and Stream Survey.

PROF. LUIS RENÉ RIVAS, Curator of Zoological Collections, Colegio de la Salle, Vadado, Habana, Cuba, has just commenced research in ichthyology at the U. S. National Museum under a Latin-American fellowship from the John Simon Guggenheim Memorial Foundation. Prof. Rivas expects to be at the National Museum for a few months before continuing his work in other institutions in this country.

DR. F. P. KOUMANS, curator of fishes in the Rijks Museum van Natuurlijke Historie at Leiden, reports that he and his family have survived the German occupation, and that because of economic conditions in Holland, he hopes to move to America. During the five years of war, Dr. Koumans finished a report on the fishes of the Snellius Expedition, prepared a key to the Indo-Pacific genera of gobioids, wrote the volume on gobies for Weber and de Beaufort's *Fishes of the Indo-Australian Archipelago*, and has begun the study of Elasmobranchii for the same work.

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